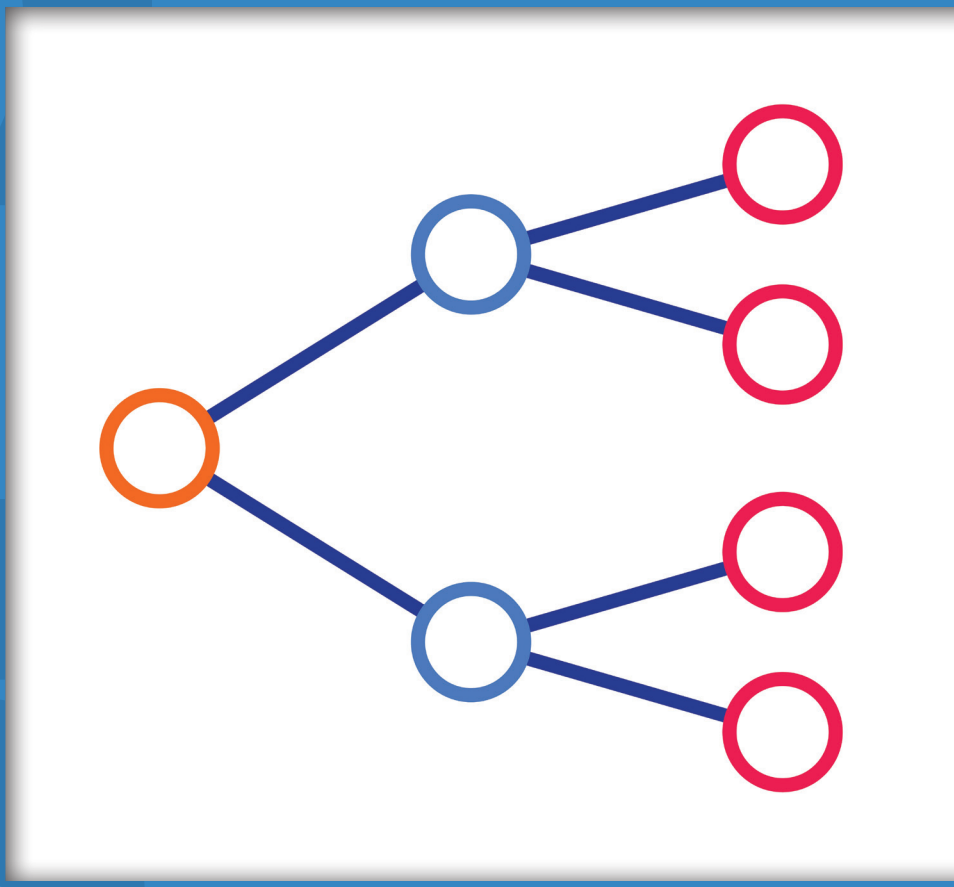
JOURNAL OF BEHAVIOURAL ECONOMICS AND SOCIAL SYSTEMS

Volume 4, Number 2, 2022



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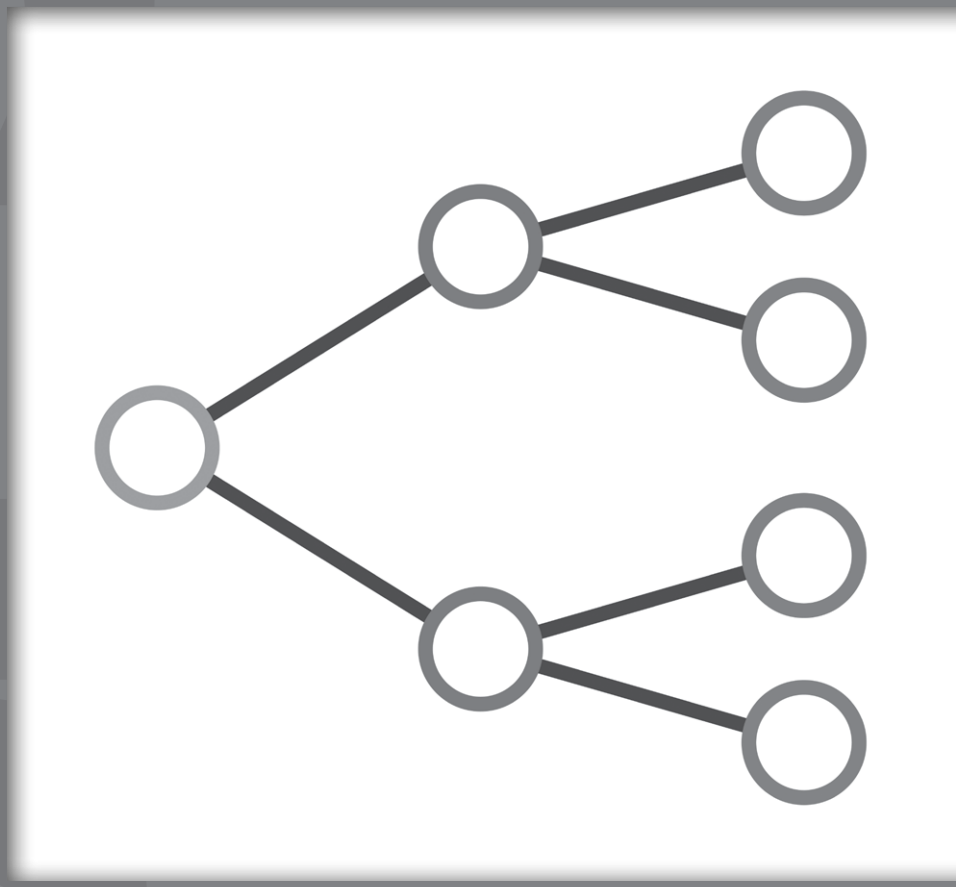

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All information is current as of December 2022

First published 2022

Published by:
Global Access Partners Pty Ltd
24-30 Wellington Street, Waterloo NSW 2017 Australia

Journal of Behavioural Economics and Social Systems (*BESS*®)
Volume 4, Number 2

ISSN 2652-290X (Online)
ISSN 2652-2896 (Print)

FOREWORD

Nobel Prize Outreach CEO Laura Sprechmann and GAP Chairman Peter Fritz AO sign the partnership agreement © 2022 Nobel Prize Outreach. Photo: Clément Morin

Global Access Partners' recent agreement with Nobel Prize Outreach to hold a Nobel Prize Dialogue Sydney on *The Future of Decision Making* will create a broader international forum to explore the neuroscience of individual thought and mechanics of group interaction. The Dialogue's thought leaders, presenters, and participants will include Australian and international Nobel Prize laureates, political, cultural, academic, and corporate experts, and active young changemakers to ensure long-term impact.

The Nobel Prize Dialogue Sydney will open with a virtual pre-event in June 2023 for over a hundred select participants, with three plenary sessions led by a focused thought leader panel and a free-flowing Chatham House debate. With a high-level Steering Committee to advise on content, topics and speakers and an experienced event management group to oversee the planning, communication and operations, these cross-disciplinary dialogues will turn good ideas and intentions into concrete results.

The Dialogue will also examine the differences between 'first track' and 'second track' engagements.

In a traditional 'first track' cabinet meeting, participants follow a prescribed agenda that outlines and justifies several alternative solutions to a particular issue. Cabinet papers are structured in terms of 'problem-solutions': three proposals may be debated and discussed before one is chosen. Discussions are within a limited group of people, with this constrained set of options for its members to work with.

The 'Second Track' is a reverse process that invites relevant, experienced people to come together to consider the issue at hand. They participate as informed individuals rather than representing a department, organisation or pre-defined position. They are 'experts in life' and the issue, so they concentrate on the practical side of implementing an effective solution.

Second Track participants offer strategies based on their individual insights but hone and adopt them through the **collective experience** created through their discussions.

Over several meetings, the Second Track group agrees on several recommendations which are then followed up and acted upon. *Access* (to appropriate participants) is followed up by *Influence* (the recommendations are adopted), which creates *Action* (implementation), which leads to impact.

Global Access Partners' success demonstrates evidence of this methodology's effectiveness. Over the last 25 years, GAP taskforces have discussed a wide range of 'wicked problems', offering solutions that non-profits, commercial companies and governments have adopted.

While the First Track is a compliance process in which higher ranks hold sway and decision-makers draw solutions from a predetermined list of options, the Second Track is more flexible and creative, encouraging individuals to share their 'dangerous idea'.

Neuroscience suggests that creativity and compliance originate from different areas of the brain, producing radically different outcomes. While first-track thinking has its place, second-track thinking must also be incorporated into managing our communities, cities, states, nation, and planet.

Too many critics disapprove of government decision-making without contributing to better solutions themselves. Rather than ignoring or disparaging them, governments should encourage these critics to volunteer their ideas and effort to deliver the change they call for. The Second Track offers systems in which citizens, as well as government, take responsibility for the outcomes of those decisions.

By creating new, broader civic engagement and volunteering opportunities such as the Second Track process, we can reinvigorate our democracy and circumvent hierarchical systems of engagement and decision-making.

The economic paradigms which underpin our political system must also be revisited and reformed through the consideration of wealth and value in broader terms than mere monetary value to ensure more equitable distribution and more sustainable use of scarce resources.

Peter Fritz AO
Sydney, December 2022

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CONTENTS

ARTICLE

AUSTRALIAN MODERN-DAY SLAVERY: A SYSTEMS PERSPECTIVE

Prof James Guthrie AM, Prof John Dumay, Prof Grant Michelson and Dr Tracey Dodd

The complexity and opacity of global supply chains make modern slavery a real risk for companies that engage in large-scale international production and distribution. Researchers at Macquarie and Adelaide Universities explore how adopting a social system perspective might strengthen the interrelationships between governments, companies, civil society and academia and shed new light on developments in theory and practice that could help eliminate modern slavery.

INTRODUCTION

'Modern slavery, one of the most abhorrent crimes against humanity, is a profitable international business thriving on an unprecedented scale. It generates an estimated US$150bn in illegal profits annually … slavery operates in a hidden form in the complex global value chains governed by powerful multinational corporations.'[1]

Guthrie and Dumay (2021) argue that new approaches are needed to solve those complicated and genuinely complex problems confronting business and government. Wicked problems involve social justice, social change, climate change and social economy issues characterised by stakeholder multiplicity and policy confusion.[2] Addressing these difficulties requires a social systems perspective – one that considers uncertainty but still allows us to negotiate politically and work effectively in networks to break down the boundaries between academia, industry and policy-makers. In this regard, our ability to handle future challenges is essential.

1. Stringer and Michailova, 2018, p. 194
2. Guthrie and Dumay, 2021

Using complex adaptive systems, we must build our resilience and implement ways to sense the small changes to our world that may have catastrophic impacts. Nevertheless, building this resilience is difficult because government policy typically develops around known scenarios and knee-jerk reactions to social wrongs and catastrophes. However, such policies are like closing the gate after the horse bolts. Thus, we must cope as best we can with wicked problems such as modern slavery. We must also deal with social justice, climate change and the social economy. Guthrie and Dumay (2021) argue that we must start to build social systems that involve the best minds who collectively and continually look for the outliers that may one day cause the next calamity. Without such systems, we will always live on the edge of chaos!

Slavery is an unethical practice. Over the last two centuries, parliaments worldwide have committed to making laws to end slavery.[3] The glaringly inhumane practice of chattel slavery – a person being owned or sold by another – was prohibited and criminalised in countries from the early 1800s onwards. Later, other forms of slavery, such as forced labour, human trafficking, debt bondage, involuntary prostitution and forced marriage, were prohibited.[4]

Tackling slavery in contemporary times has become more demanding.[5] Engaging in modern slavery can be commercially rewarding for nation-states and corporations, and slavery is entwined with the global economy and therefore challenging to detect and unravel.[6] A consumer product may be more affordable in one country because of oppressive and underpaid manufacturing conditions in another country.[7] Modern slavery may occur within a family or domestic setting when one person forces another into servitude or marriage. Alternatively, modern slavery may be a voluntary arrangement endured by a person without support.[8]

Internationally, the EU has banned products made using forced labour,[9] a move that could further increase strains in its trade relations with China in the light of allegations about forced labour in the province of Xinjiang. Shoes, clothes and commodities such as timber, fish and cocoa are among the products most likely to be affected by the EU bans. This European development closely follows a new US federal law called the Uyghur Forced Labour Prevention Act, enacted in late December 2021.[10] This legislation requires companies to prove that any goods with ties to Xinjiang are free of forced labour.

Modern slavery is a problem for companies operating across international borders, with the United Nations (UN) and signatory countries targeting its elimination by 2030. Under the UN Guiding Principles on Business and Human Rights, entities are responsible for respecting human rights in their operations and supply chains, including acting to prevent, mitigate and, where appropriate, remedy modern slavery in entity operations and supply chains. The UN Sustainable Development Goals[11] also focuses on modern slavery in its Employment and Decent Work Goal (Goal 8) with the aspiration to, among other factors, '…eradicate forced labour, end modern slavery and human trafficking…' (Target 8.7).

3. Australian Government, 2022
4. Christ et al., 2022; Haigh and De Graaf, 2009
5. Dodd et al., 2022; Searcy et al., 2022
6. Walk Free Foundation, 2022
7. Gutierrez-Huerter et al., 2021
8. Moussa et al., 2022
9. Javier Espinoza and Andy Bounds in Brussels September 12 2022, https://www.ft.com/content/8ebd3114-ab7b-4345-be0d-9ed57ca8daf2
10. https://en.wikipedia.org/wiki/Uyghur_Forced_Labor_Prevention_Act
11. https://www.undp.org/sustainable-development-goals

However, legislation is only one means of eliminating slavery. Furthermore, notably, slavery usually does not occur significantly in the countries enacting and enforcing these pieces of legislation. Hence, another approach is to use an information disclosure strategy about operations and supply chains to change company behaviour. The Australian Government's recent issues paper[12] states that slavery cannot be stopped simply by a law declaring it illegal. The paper highlights that it may be difficult to pinpoint any exact locations or product components linked to slavery practices. Distinguishing modern slavery from other forms of exploitation, such as substandard working conditions and underpayment, can also be challenging. For this and other reasons, the Government's reporting requirements focus on large businesses, the Commonwealth, and other entities with the capacity and leverage to drive change throughout their supply chains.[13]

This research paper is motivated by global societal concerns over modern slavery. Over the last decade, modern slavery has been the fastest-growing form of organised crime and is found on every continent,[14] including Australia.[15] The Global Slavery Index, published by the International Labour Organization and the Walk Free Foundation,[16] reports that in 2021, modern slavery has increased by nearly 10 million people since 2017, with more than 49.6 million people globally subject to some form of modern slavery. About 15,000 of these people live in Australia, with a prevalence of 0.6 victims for every thousand people in the country. Efforts to identify and eliminate modern slavery have thus far had limited impact as they span national borders and rely on normative pressures (e.g., reputation risks). They also depend on effective law enforcement and efficient judicial practices in different countries. New approaches that can foster greater and continued collaboration are required. Hence, we pose the following research question: How can a social system perspective, which encompasses and strengthens the interrelationships between individuals, groups and institutions, shed new light on pathways to eliminate modern slavery?

BACKGROUND

Modern slavery is a significant issue in Australian supply chains. It is most prevalent when entities import goods produced using modern slavery practices. High-risk products include laptops, smartphones, garments, fish[17] and even chocolate.[18] Evidence shows that forms of modern slavery are also present in many goods and services produced in Australia. Hospitality,[19] retail[20] and agriculture are examples of high-risk local industries. The Australian Government tries to protect vulnerable individuals and communities in Australia and within global supply chains from modern slavery crimes, but doing so is challenging, as outlined in the Introduction.[21]

There is an international acceptance that new legal, commercial and cultural approaches are required to stop modern slavery. Britain and Australia are among several jurisdictions that have enacted related legislation, with Britain's Modern Slavery Act commencing in 2015 and Australia's Modern Slavery Act (Cth) commencing in 2019.

12. https://www.homeaffairs.gov.au/about-us/our-portfolios/criminal-justice/people-smuggling-human-trafficking/review-of-the-commonwealth-modern-slavery-act-2018
13. Wray-Bliss and Michelson, 2022
14. Crane et al., 2019
15. Christ and Burritt, 2021
16. International Labour Organization and Walk Free Foundation, 2022
17. Deloitte, 2020, p. 6
18. Perkiss et al., 2021
19. Yang et al., 2020
20. Yang et al., 2021
21. Australian Government, 2020

The Australian Government has also developed the National Action Plan to Combat Modern Slavery 2020–2025.[22] The Act and Plan aim to build on prior initiatives, such as the 2004 Action Plan to Eradicate Trafficking in Persons and the National Action Plan to Combat Human Trafficking and Slavery 2015–2019. The 2020–2025 Plan aims to 'establish a future where no one is subjected to modern slavery, and the human rights of all people are valued equally'.[23] The Plan identifies its mission as working with others to prevent and combat all forms of modern slavery actively, wherever it occurs, including by supporting, protecting, and empowering victims and survivors.[24]

According to Christ and Burritt,[25] there are two regulatory options for addressing modern slavery – command and control regulation with sanctions, or self-regulation with no sanctions for compliance. The Australian Modern Slavery Act has taken the self-regulation approach. It places the onus on large public and private entities to scrutinise their business operations to ensure that slavery risks are not occurring within their domestic or global operations or supply chains. These entities must report annually on the actions taken to prevent the risk of modern slavery from occurring. The reports are placed on a public register. The stated aim of this is to increase business awareness, transparency and support for anti-slavery measures. A public register also means others in the community can assess how earnestly and effectively individual business entities have acted to prevent modern slavery.[26] However, there are no significant sanctions for non-compliance.

The Modern Slavery Statements required by the Act must identify the reporting entity and address the following mandatory criteria: the reporting entity's structure, operations and supply chains; and modern slavery risks in the reporting entity's operations and supply chains (including those of subsidiary entities). As a general guide, Modern Slavery Statements should also include the actions taken to address modern slavery risks and any remediation strategies taken.[27]

One noteworthy aspect of the Act is that it does not have any punitive measures should a company not comply. Wray-Bliss and Michelson[28] examine how the Act came to have no penalties in their critical and discursive analysis of submissions to an Australian inquiry into establishing the Act. They found that the dominant position across the submissions was that any legislation introduced by the Australian federal parliament around modern slavery must be without penalty or consequence for business. Included here is the stipulation that not complying even with the minimal reporting requirements of the Act should be penalty-free. For example, in a submission to the Inquiry, Norton Rose Fulbright states, 'The legislation should not include fines or other penalties for non-compliance with the reporting requirement' (submission 72, p. 3). Mining company South32 submitted that any new Act must 'encourage businesses to examine their supply chains and identify instances of modern slavery without fear of liability' (submission 81, p. 4). The Walk Free Foundation submitted, 'Our approach must encourage business to look and find, and be open about what they discover.

22. Australian Government, 2020
23. Australian Government, 2020
24. Australian Government, 2020
25. Christ and Burritt, 2021
26. Wray-Bliss and Michelson, 2022
27. Australian Government, 2018
28. Wray-Bliss and Michelson, 2022

As a community, we must support, not shame them' (submission 91, p. 5).

Rather than a penalty or legal liability for non-compliance, those making submissions argued that the market mechanism of reputational risk should be sufficient.[29] As the Australian Food and Grocery Council outlined in its submission, 'In line with the Australian Government's deregulation agenda, the Committee may consider whether the measures outlined above can be built upon, recognising that there is a significant reputational incentive for businesses to be proactive in addressing human rights concerns including modern slavery' (submission 77, p. 4). Similarly, the National Australia Bank wrote, 'Whilst there are no material statutory sanctions for non-compliance to accompany these requirements, the princip[al] deterrent for not taking steps to publish a statement is driven largely by the potential reputational risk of no action. Reputational risk can be a strong motivator for public companies with well-known brands. NAB supports this non-punitive approach' (submission 54, p. 4).

REVIEWING THE EVIDENCE

In this section, we present a review of Australian research into the legislative requirements for environmental, social and governance (ESG) disclosures and their impact on disclosure practice. This is followed by several findings from the issues paper that is the basis of the Australian Government's review of the Act.[30] This analysis provides insights into the effectiveness of the Act to date.

Effectiveness of legislation on ESG disclosures

Previous Australian research shows that prescriptive disclosure regulations based on the principles of command and control have had little impact on providing information to the public about ESG practices. For example, the *Corporations Act* requires fund managers to attach certain disclosures to retail investment products in those products' Product Disclosure Statements (PDSs). More specifically:

> **Section 1013D(1)(l) of the Corporations Act states that where a financial product has an investment component, its issuer must include in the PDS the extent to which labour standards or environmental, social or ethical considerations are considered in selecting, retaining or realising an investment.**

Haigh and Guthrie[31] analysed these ESG disclosures in Australian PDSs with the primary research question of whether or not the legislatively required disclosures did incorporate governance practices, environmental matters, labour standards and other social or ethical considerations. Overall, they found that the Corporation Act's prescriptive disclosure regulation did little to extract the desired information from corporations. If anything, the findings were that the corporations and lawyers stripped out any meaningful voluntary information from the PDSs.

In another paper, Haigh and Guthrie[32] explored socially responsible investment (SRI), investment management, the regulation of financial services, and social accounting by providing a comprehensive analysis of both the investment methods used in SRI products and examining regulated social reporting in financial services. Australian and New Zealand regulations require that self-declared SRI products provide details on the methods used to construct the investment portfolio in a proforma way. The aim, as evidenced by parliamentary debates and other public reports, was to increase the comparability of SRI products. However, their analysis shows that before this regulation came to

29. Wray-Bliss and Michelson, 2022
30. Australian Government, 2022
31. Haigh and Guthrie, 2010
32. Haigh and Guthrie, 2009

pass, the disclosures included information on the diversity of origin, purpose and method. Regulated standardised disclosure can be expected to detract from a plurality of interests.[33] Hence, both studies highlight the failure of compulsory command and control style disclosures by corporations to promote transparency in these matters.

Effectiveness of modern slavery disclosures

Several research projects have involved analysing the listings in Australia's Online Registry of Modern Slavery Statements, which are worth discussing. For example, The Australian Council of Superannuation Investors (ACSI)[34] *Moving From Paper to Practice: ASX200 Reporting Under Australia's Modern Slavery Act* examines the modern slavery statements submitted in the first reporting cycle by 151 ASX200 companies. ACSI members are asset owners and institutional investors that own an average of about 10% ($) of ASX200 companies. This study assesses statements against 41 quality indicators and eight legal compliance indicators. While the quality of modern slavery reporting varies by sector and revenue level, the overall finding is that significant room for improvement in the quality of reporting by ASX200 companies exists. The average quality score for statements was 15.4 out of a maximum of 41 points, and only 31 statements scored 20 points or more. The statements generally aimed to satisfy the Act's legal reporting requirements but not to deepen disclosure of operational risks – a 'paper over practice' approach. The study reports that most companies complied with the minimum requirements of modern slavery reporting within the ASX200.

A study by the Monash Business School[35] analysed the quality of 239 Modern Slavery Statements submitted in 2020 by ASX300 companies. This study scores each statement according to 31 criteria grouped into five categories (multiple researchers assessed each statement). The statements were graded from A (highest) to F (lowest). Only six companies received an A rating; 36% received a failing grade of E or F, and the majority were rated C or D. The ASX300 companies were identified by name in the final ratings. Therefore, except for six companies that received an A rating, the rest only produced statements that were compliant in terms of the legal requirements of the Modern Slavery Act.

The Human Rights Law Centre[36] examined 102 modern slavery statements across four sectors with known modern slavery risks: garments from China, rubber gloves from Malaysia, horticultural produce from Australia, and seafood from Thailand. This analysis had a dual focus. One was to examine if the statements met the Act's mandatory reporting requirements, with statements scored against 66 indicators in a three-stage assessment process. The report found that only 23% of companies fully addressed the mandatory requirements.

The Walk Free Foundation[37] analysed reporting under the UK and Australian Modern Slavery Acts by 50 companies in the garment sector where modern slavery is rife. The report describes the scale of the industry and the difficulties in providing transparency and enforcing workers' rights at multiple stages of the garment supply chain. The report finds that regulated reporting is inadequate under UK and Australian laws. A major weakness is the governments' failure to explain how risk assessment tools can be used beyond making policy statements to also analyse supply chains. A strong theme of the report is that disclosures under the Act must go beyond mere reporting compliance with overly weak regulation to eliminate modern slavery risks.

33. Gray and Jenkins, 1993
34. Australian Council of Superannuation Investors, 2021
35. Monash University Business School, 2021
36. Human Rights Law Centre, 2022
37. Walk Free Foundation, 2022

A study by International Justice Mission Australia[38] analysed 404 modern slavery statements – 332 from entities sourced from or operating in India. The study had 20 researchers analyse the statements against 44 criteria. One part of the study looked broadly at modern slavery reporting, and the other looked at reporting on modern slavery risks in India as a high-risk region. A key finding in the first part of the study was that more than 90% of statements identified potential modern slavery supply chain risks, but fewer than 30% identified risks beyond the first tier of the supply chain. Many corporations are exposed to significant supply chain risk and only do the minimum required under the *Modern Slavery Act*. This study found that nearly 75% of statements either did not satisfy reporting obligations or only met the minimum reporting obligations. Nearly 85% of company statements did not indicate a single instance where a company responded to actual or alleged modern slavery in their operations or supply chains. Findings from the report include: some 43% of corporations met half or less of the study's quality indicators; the majority of solid statements (58%) were large corporations > $1b revenue; the majority of weak statements (79%) were from smaller corporations with < $500m revenue; only 24% of statements revealed the status of workers, for example, whether they are part-time, full-time, contractors, skilled or unskilled; the weakest section of most responses was on due diligence and remediation.[39]

The International Justice Mission Australia report recommends that entities use organisational culture in the modern slavery reporting process to engage with stakeholders, explore ways of reducing slavery rates in high-risk regions, and implement more robust due diligence measures. The recommendations for the government are to better inform entities of the risks of modern slavery in high-risk regions, partner with governments in those regions to improve justice system responses to modern slavery and implement more robust controls on imports linked to modern slavery risks.

Therefore, of the six research projects that have assessed the modern slavery statements published in the Online Register for Modern Slavery Statements, all have found poor disclosures and little disclosure of actual management practices to eliminate the risks associated with modern slavery in supply chains.

Review of the Modern Slavery Act

On 31 March 2022, then Assistant Minister for Customs, Community Safety and Multicultural Affairs, the Hon. Jason Wood, MP, announced a statutory review of the Modern Slavery Act 2018, planned as part of Australia's National Action Plan to Combat Modern Slavery 2020-25. Subsequently, in September 2022, the Commonwealth of Australia released an issues paper to guide the review.[40] According to the issues paper, Australia has more transparency and understanding of the links between modern slavery practices and global supply chains. As of 30 June 2022, 4,399 modern slavery statements had been published in the Register, covering the activities of an estimated 6,293 entities from 42 different countries. Furthermore, several formal consultation groups comprising representatives from civil society and the business now advise the government on modern slavery, including the National Roundtable on Human Trafficking and Slavery and the Modern Slavery Expert Advisory Group.[41]

While there have been advances, it has not been easy sailing for the Act as only 41% (out of 1727 statements) of companies submitted non-compliant

38. International Justice Mission Australia, 2022
39. https://ijm.org.au/news/media-release-damning-new-report-highlights-significant-modern-slavery-risks-facing-australian-businesses/
40. Australian Government, 2022
41. Australian Government, 2022, p. 13

statements in the first reporting cycle (2020) and only 28% (out of 3429 statements) in the second (2022).[42] Non-compliance is about the form of the statements, not the substance. The Act is silent on substance. However, it is clear from these statistics and the five studies that have examined the statements that self-regulation is not working. The non-compliance shows that many companies either did or could not effectively engage with the Act's requirements and that there is considerable room for improvement. However, the main issue is how to effectively get companies to comply with the legally mandated reporting requirements, let alone eliminate their modern slavery risks. One answer is applying penalties for non-compliance, which could be counterproductive as it places the entire responsibility back onto companies to act and report rather than considering what causes modern slavery and how it can be detected and subsequently eliminated.

A SOCIAL SYSTEM PERSPECTIVE ON MODERN SLAVERY

As outlined in the Introduction, modern slavery is a highly profitable crime, so it is not in the perpetrator's interest to disclose it. Supply chains have many tiers, and the transparency and traceability of these chains become opaque as the number of tiers increases. For example, in the global cocoa (chocolate) supply chain, cocoa beans pass from millions of small farmers through buyers, resellers, cooperatives, producers and retailers before finally reaching consumers. Thus, in an industry with millions of small farmers, poor infrastructure and considerable unregulated farming and commercial practices, achieving transparency in the many tiers of the supply chain is very challenging.

For illustration purposes, asking a chocolate company to be responsible for eradicating modern slavery in its supply chain would be very difficult because of this opaqueness. Thus, reducing the opaqueness requires the involvement of all actors involved in the supply chain, including governments, companies, civil society and academia. This involvement is needed because modern slavery is a wicked problem with no easy solutions from a theoretical perspective.[43] One of the problems with easy solutions is that they can have unintended consequences. As the Voice Network outlines, easy solutions mean:

> **that all actions must be designed with a specific awareness of the challenges faced by supply chain actors of the incentives that could lead them to engage and must embed mitigation measures addressing unintended consequences.**[44]

For example, in the cocoa industry in West Africa, where modern slavery exists, a simple solution could be to place an immediate ban on all cocoa sales that could not prove that the beans were slave-free. However, that could eliminate most sales from West Africa, forcing the industry into chaos, poverty and civil unrest.[45] Thus, a focus on the interactions between governments, companies, civil society, academia and other actors is urgently needed. Plus, those interactions should entail cross-sector alliances and partnerships, among various other interactions.[46]

Governments

While several governments have implemented modern slavery legislation, that alone will not prevent it. Governments need to take a proactive approach and work with companies towards education and assist them in identifying the

42. Australian Government, 2022, p. 22
43. Rittel and Weber, 1973
44. VOICE Network 2022
45. Perkiss et al., 2021
46. Yaziji and Doh, 2009

products and industries that pose the most significant risks. In doing so, they should help provide a nationally available data source that helps break down the value chain for these industries and products to its source. If that were done, there could be a nationally coordinated approach to eliminating slavery from a supply chain.

In this coordinated approach, we must also not forget that most modern slavery does not sit in the domestic supply chain but comes primarily from externally sourced products. Therefore, it is necessary to work with the governments of other countries that are the sources of modern slavery. One could argue this is problematic because the political will or corruption in the source country might not be open to a discussion about eliminating the problem. For example, the Chinese Government may be reluctant to cooperate with the plight of the Uyghur people and products made in Xinjiang.[47] Therefore, this recommendation is more straightforward to articulate than enable, but that does not mean that it is not still worthwhile and feasible. For example, the International Labour Organization (ILO) reports that Uzbek cotton is now free from systemic child and forced labour,[48] highlighting that tackling the problem with the commitment of the source government can be a solution.

Companies

While the opaqueness of global supply chains remains a problem, it is not an excuse for substantial and multinational companies not to act. For example, many companies have more resources and turnover than a small nation's GDP and often profit from modern slavery. For example, Perkiss et al. examine how Nestlé uses impression management to distance itself from child and forced labour in their corporate reporting.[49] The problem of child and forced labour is widely known, especially in West Africa. However, in 2001, eight significant cocoa processing and manufacturing companies working in the cocoa supply chain, alongside representatives from the US and Ivory Coast Governments, committed to eradicating the worst forms of child labour and adult forced labour on cocoa farms in West Africa with the signing of the Harkin-Engel Protocol.[50]

Nevertheless, despite the Harkin-Engel protocol, there are continuing allegations that child and forced labour continues in West Africa.[51] However, according to a recent market analysis report, in 2019, the global size of the chocolate market was valued at USD 130.56 billion, and this is expected to grow at a compound annual growth rate (CAGR) of 4.6% from 2020 to 2027.[52] However, farmers still live in poverty, despite the industry having more than adequate resources to pay farmers a living income and reduce the need for children and forced labour.[53] Chocolate is only one example of high-risk products and industries involving large international and Australian companies that regularly profit from modern slavery in their supply chains. Nevertheless, despite legislation banning or attempting to eradicate the problem, consumers in Australia are still buying and consuming these products. Therefore, an opportunity exists for many organisations to take the lead and ensure their products and processes are free of forced labour and modern slavery.

Civil society and academia

Finally, civil society and academia also need to play a role in eradicating modern slavery. Here, we advocate that these actors can contribute as third

47. https://www.theguardian.com/world/2022/jun/21/us-ban-on-cotton-from-forced-uyghur-labour-comes-into-force
48. https://www.ilo.org/global/about-the-ilo/newsroom/news/WCMS_838396/lang--en/index.htm#:~:text=Almost%20two%20million%20people%20are,according%20to%20new%20ILO%20findings
49. Perkiss et al., 2021
50. https://www.slavefreechocolate.org/harkin-engel-protocol/
51. https://www.theguardian.com/law/2022/apr/03/cadbury-faces-fresh-accusations-of-child-labour-on-cocoa-farms-in-ghana
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53. https://www.chocolatescorecard.com/blog/earning-a-decent-living-through-cocoa-why-is-it-so-hard

parties to monitoring and understanding the impact of government policies and legislation in consumer and producer countries. By examining these impacts, they can also independently advise on improving policy and legislation, including traceability and transparency provisions.[54] Thus, we advocate that civil society and academia have a vital role in establishing the ground rules for practice in the future of Australia's Modern Slavery Act and how companies respond to it.

How companies respond is also vitally important, along with how civil society and academia engage with them to help eliminate modern slavery. Most significant is the opportunity to open a dialogue with companies on their management performance, help them understand their supply chains, and identify and mitigate modern slavery risks. In our research, we have done this in two ways. First, as outlined by Dodd et al., research was engaged inside an organisation to assist with implementing management practices and a control system capable of identifying modern slavery risks and the opportunity to mitigate them if needed.[55]

Second is our involvement with the charity 'Be Slavery Free' and the production of the Chocolate Scorecard 2022 and beyond.[56] In this research,[57] we engage in a dialogue between academia, civil society and companies to produce a scorecard on corporate performance in the chocolate supply chain. The research contributes by practically applying critical dialogical accountability theory that considers all parties accountable, not just businesses.[58] The focus is on working with industry leaders to find and prevent modern slavery, thus providing a robust social system model of academic and civil society interaction with industry that engenders real-world change. In this project, the companies are interested in engaging because their performance is being assessed by us and made public. Thus, from a reputational perspective, most companies do not want their performance to be lower than their competitors, so they are motivated to engage in a dialogue with us on how to improve their performance. The motivation translates into proactive policies that directly improve the lives of people working in their supply chains.

CONCLUSION

Modern slavery is an abhorrent and illegal activity. However, the motivation for depriving humans of their freedom is often attributed to it being a highly profitable activity. Unfortunately, modern slavery appears to prosper due to the complexity and opacity of corporate global supply chains, among other factors. This paper was motivated by a desire to explore how a social system perspective for this wicked problem of modern slavery in supply chains might best be addressed. In this context, we examined the legislative remedy – including the features of the Modern Slavery Act in the Australian jurisdiction – with relatively few enforcement mechanisms for non-compliance. Lack of enforcement is disappointing but unsurprising, given the extensive lobbying by Australian companies in the lead-up to the Act for a law that minimised any additional 'regulatory burden'. Further inquiry into the voluntary substantive disclosure quality of modern slavery statements in Australia highlighted a consistent pattern: the extent of compliance was variable, with many companies not even satisfying the formal minimum reporting requirements.

54. Islam and Van Staden, 2022
55. Dodd et al. 2022
56. https://www.chocolatescorecard.com/
57. See, Etelle Higonnet, a research team member, was interviewed for the story. (https://www.washingtonpost.com/climate-solutions/2022/10/14/halloween-candy-chocolate-deforestation-labor/
58. Dillard and Vinnari 2019

While governments are critical stakeholders in remedying modern slavery through legislation, we contend that enacting new laws alone is insufficient. In Australia, the Modern Slavery Act has raised awareness about the plight of deplorable conditions for many working in onshore and offshore supply chains. However, sanctions for non-compliance are limited mainly to reputational risk rather than direct financial penalties. We contend that adopting a social system perspective requires cultural change encompassing the interactions and interrelationships between individuals, groups and institutions and is best placed to reveal new pathways and configurations to eliminate modern slavery.

A social system perspective includes governments and their various agencies (law enactment and enforcement), companies, civil society organisations such as NGOs, and academia. For their part, companies need assurance that ethical and slavery-free labour standards are occurring in their supply chains. However, it is uncommon for them to always oversee such practices beyond their first- or second-tier suppliers. Delving into the multiple supply-chain tiers is one area civil society and academia can contribute in terms of helping to monitor, educate and conduct research that can help policymakers and satisfy corporate interests. A social system perspective assumes that mutually beneficial outcomes can result when different individuals, groups and institutions collectively seek to cooperate to address a significant problem. With nearly 50 million people trapped in modern slavery globally, we believe developing and strengthening a multi-actor and multi-institutional approach is a comprehensive way to eradicate such human suffering and indignity.

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ARTICLE

MODERN SLAVERY DISCLOSURES IN MINING: A COMPARISON OF LARGE UK AND AUSTRALIAN COMPANIES

Dr Katherine L. Christ, Prof Roger L. Burritt & Heather Prider

Based a sample of major UK and Australian mining companies, this study explores what corporate disclosures about modern slavery tell us about institutional influences. Researchers from the Australian National University and University of South Australia conclude that transparency-promoting legislation on modern slavery can be a powerful motivator for change.

INTRODUCTION

Slavery was abolished by most countries over 100 years ago yet remains pervasive in contemporary society. Modern slavery, as it has come to be known, incorporates a range of practices that include forced labour, debt bondage, child labour, sexual servitude and human trafficking.[1] Although modern forms of slavery can affect individuals within private or domestic settings, one of the largest areas of potential concern is the corporate sector, with estimates suggesting that more than 20 million individuals are enslaved in corporate supply chains worldwide.[2] As a result, modern slavery is embedded within many products used worldwide daily.

Given that commercial institutions are a part of the problem, they can also be a part of the solution. A growing number of developed countries have legislated against modern slavery and require large organisations to provide accounts not only of their operations but also those of their supply chains.[3] Supply chain-based disclosure legislation indirectly extends the jurisdictional reach required to break down the complex web of slavery-related activities

1. New, 2015
2. International Labour Organization, 2017
3. LeBaron and Rühmkorf, 2017

that pervade every continent and industrial sector.[4] However, this approach has been criticised by some as a mild form of law.[5] Specifically, this relates to penalties that are either non-existent or reputational, which means that regulatory requirements can often be met by merely reporting that no action has been taken.[6] That formal regulation is mainly designed to encourage voluntary self-regulation, which might not be effective.[7] Others look for a broader, international solution, although this is also disparaged because of its voluntary nature and commensurate lack of enforcement.[8] Also championed is a mix of national, international and self-regulation through industry or individual codes of conduct.[9] Despite these governance mechanisms, it remains of concern that institutional pressures associated with globally unacceptable activities can be manipulated and resisted locally by developing organisational capabilities that allow slavery to continue.[10] The newness of modern slavery research in the context of commercial activity has meant evidence about the actual practice on which these criticisms of recent governance are based is relatively weak, and the area requires further development and debate.[11]

Transparency-based modern slavery legislation is relatively new, and little is known about how organisations navigate the emerging institutional landscape.[12] In order to ensure modern slavery governance continues to develop in a way that is effective beyond lip service, there is a need for evidence relating to the corporate reaction across countries and contexts. A logical place for this agenda to commence is by assessing the nature of company disclosures themselves. In other words, there is a need to consider what organisations are doing, or say they are doing, about eliminating modern slavery practices and why they are doing it.

This study contributes to the literature by evaluating modern slavery disclosures made by large mining companies. Mining has a chequered background and questionable social legitimacy, given its activities take place in remote places far from workers, making it prone to modern slavery. In his seminal work, Crane[13] identifies mining as an industry in which modern slavery flourishes, because of its geographic isolation, the low education of workers and high unemployment levels in some countries, physical, political or psychological distance leading to dependence and low opportunity for escape, and traditions, entrenched inequalities and religious beliefs. The focus here is on disclosures of a small set of large listed Australian and UK mining companies. The contrast between companies in the two countries is of interest because one country, the UK, enacted modern slavery legislation in 2015, while at the time of this study, legislation about reporting in Australia remained prospective (Modern Slavery Act, 2018 (Cth)). In investigating this issue, the following research question is considered:

> **What do disclosures about modern slavery in supply chains tell us about institutional influences on UK and Australian listed mining companies?**

We explore disclosures made by 20 mining companies, ten listed in the UK and ten in Australia, using thematic analysis. To provide a theoretical understanding of the actions

4. Crane, 2013
5. LeBaron and Rühmkorf, 2017
6. New, 2015
7. Feasley, 2016
8. Feasley, 2016; New, 2015
9. Feasley, 2016
10. Crane, 2013
11. Guthrie and Dumay, 2020
12. Crane, 2013
13. Crane, 2013

undertaken by companies in the two countries, the study draws on new institutional sociology and explores the interplay of coercive, normative and mimetic isomorphic pressures in modern slavery. The results provide a basis for guiding policy developments, practice and further research across time and contexts.

The remainder of this paper is arranged as follows. The next section examines existing literature in this area, and the paper's theoretical and institutional foundations, after which the research method used to undertake the study is discussed. Findings are then presented, followed by a discussion and a short conclusion.

LITERATURE REVIEW AND THEORETICAL FRAMING

Modern slavery has defied a generally accepted legal definition but broadly refers to severe exploitation of workers for economic gain.[14] This study focuses on modern slavery within corporate supply chains, including different forms of forced labour, debt bondage, human trafficking and child labour.[15] Modern slavery in supply chains is characterised by factors that result in the worker being unable to leave the workplace for reasons ranging from the threat of harm, debt bondage and withheld wages, to the retention of passports.[16]

Modern Slavery in Supply Chains

The last decade has seen the unambiguous criminality of modern slavery gain traction with governments and non-government organisations (NGOs) worldwide, leading to legislation to combat the practice in several jurisdictions (see Table S1, supplementary material).[17]

A feature of most slavery-related laws is the requirement for increased disclosure by corporate entities, the intention being to encourage take-up of decision-making and management practices that aim to identify and end modern slavery in enterprise supply chains.[18] One of the earliest examples of modern slavery-related legislation is the California Transparency in Supply Chains Act of 2010 (see Table S1, supplementary material). Building on the momentum emerging from California, the UK Modern Slavery Act was introduced in 2015. The UK Act includes a supply chain disclosure provision like the Californian Act. Section 54 requires commercial organisations with an annual turnover of over £36 million that produce goods or services in the UK to publish annual Slavery and Human Trafficking Statements.[19] The statements are required to detail what steps the organisation has taken during the financial year to ensure modern slavery is not occurring internally or in its supply chain. Section 54(4) of the UK Modern Slavery Act acknowledges that compliance does not mean the organisation guarantees itself to be slavery-free; rather it is taking steps to identify and prevent its occurrence. If organisations meet the reporting threshold but do not take steps to identify, prevent and eradicate slavery in their supply chains, they are required to make this fact public in their modern slavery statements.

Legislation against modern slavery has also been adopted in other jurisdictions, including France, the Netherlands and the European Union. The European Union introduced Regulation 2017/821 in 2017, with an enforcement date of January 2021, detailing a uniform approach for supply chain due diligence, with a focus on companies that source and use conflict minerals.[20]

14. New, 2015
15. Feasley, 2016
16. Gold et al., 2015
17. Craig, 2017; Gold et al., 2015. https://globalaccesspartners.org/wp-content/uploads/2023/02/Burritt_Supplementary_Material.pdf
18. Wen, 2016
19. Craig, 2017
20. Regulation (EU) 2017/821 of the European Parliament and of the Council of 17 May 2017

Australia is another country to consider corporate reporting on modern slavery in supply chains for large Australian companies.[21] A *Modern Slavery Act* has been introduced by Parliament based on many provisions of the UK Act and includes a requirement for corporations with an annual turnover of A$100 million or above operating in Australia to publish annual Modern Slavery Statements, required from 31 December 2020. Replication of the UK Act is designed to limit the regulatory burden on cross-listed companies, helping to encourage a high level of compliance.[22]

The developments listed above suggest that the institutional landscape concerning the corporate management of modern slavery risk is rapidly developing. However, little is known about how corporations manage modern slavery risk, especially operations beyond direct control in their supply chains, and how they respond to new sources of institutional pressure. Some, such as Crane,[23] argue that the nature of modern slavery makes it possible for suppliers and companies in specific settings to manipulate the institutional setting while developing organisational capabilities that allow the practice of slavery to continue unabated. These difficulties may have contributed to the apparent refusal by many large UK companies to produce a modern slavery statement in the first year in which such a requirement was compulsory.[24] The possibility of institutional deflection also suggests that available research on sustainability management might not provide recommendations that can be easily generalised to the modern slavery setting. Thus, there is a need for modern slavery-specific research that seeks to understand the organisational response to these new institutional pressures. This will facilitate the review and improvement of legislation to ensure the goal of ending modern slavery is more likely to be achieved.

Mining and Modern Slavery

This study's focus on the mining sector addresses the need for industry-specific research (Crane, 2013). Research shows that the minerals industry is one of several where the use of slavery-related labour has been found to be more prevalent.[25] Reasons identified include that mining work can be simple and non-technological, providing fertile ground for workplace abuse and the use of slave labour, whether trafficked across national borders or sourced domestically.[26] Also, unauthorised mining work is often unskilled and dangerous, meaning the risk of vulnerable people being trapped in slavery is high.[27]

Mines and quarries are point-source locations and should, in principle, be easy to identify in the presence of appropriate controls. Unlike factory work that can be relocated to hidden facilities and 'shadow factories',[28] a mine cannot be moved to a different location to hide the use of illegal labour. Nevertheless, mining often occurs in geographically isolated areas where practices are unobservable and local cultural and cognitive norms, poor governance, conflict zones and undemocratic states can rely on modern slavery. A case in point is coltan mining, coltan being a component of cell phones and other consumer electronics, and proceeds of the sale being used to fund militia groups in the Democratic Republic of Congo.[29] Another case is gold mined in Peru, where 'about one fifth of exports are illegally mined with

21. Birkey et al., 2016; Christ and Burritt, 2018; Commonwealth of Australia, 2017
22. Commonwealth of Australia, 2017
23. Crane, 2013
24. Business & Human Rights Resource Centre, 2017a
25. Bales and Trodd, 2013; Crane, 2013; LeBaron, 2016; Pierce, 2011
26. Bales and Trodd, 2013; Gold et al., 2015
27. Crane, 2013
28. LeBaron, 2014, p. 243
29. Crane, 2013

forced labor by workers who labor without work contracts, benefits, or basic safety gear'.[30] Modern slavery is not limited to small-scale mining and has been discovered in its supply chains by large companies such as the Australian-based Fortescue Metals Group.[31]

This paper compares large, listed UK and Australian mining companies. Although these companies have many similar institutional structures, especially concerning the environment for reporting on forced and child labour,[32] since 2015 the UK has had modern slavery legislation, which includes supply chain reporting requirements. The Australian Government's *Modern Slavery Act*, 2018 (Cth) has also introduced mandatory reporting obligations, and differentiating effects of institutional influences at a point of time might be discernable. These settings facilitate comment on LeBaron and Rühmkorf's[33] criticism of the UK Act as being too mild, and that methods recognized before the introduction of such legislation are inadequate.[34]

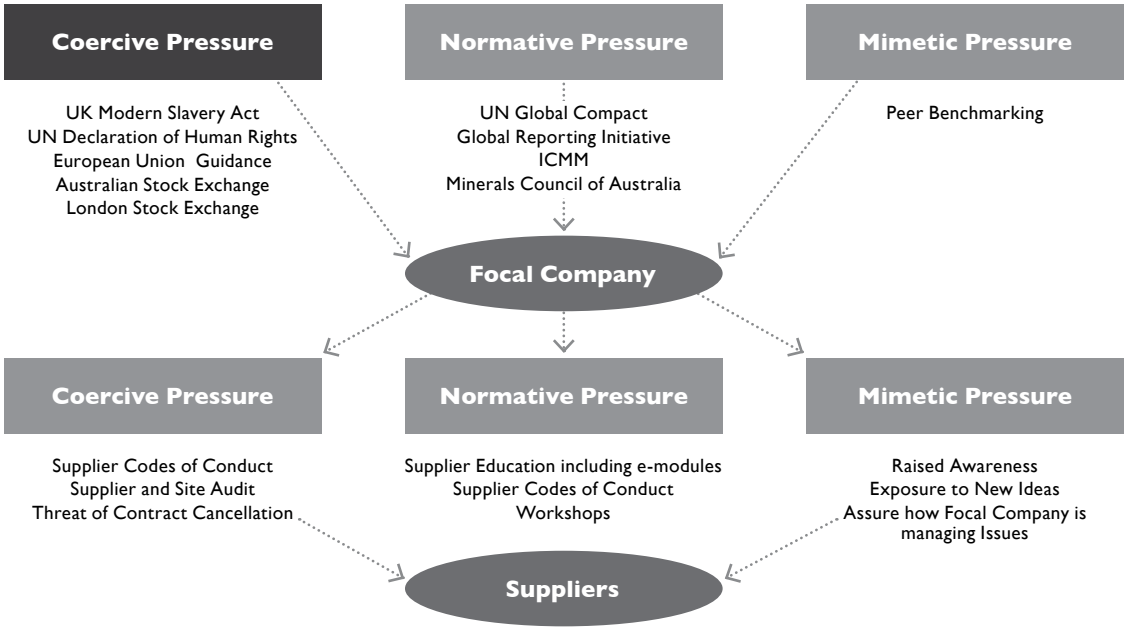
Theoretical Framing

Institutionalisation of modern slavery needs to be changed if modern slavery is to be ended. This is consistent with the United Nations Sustainable Development Goal 8 as a condition for decent work.[35] Crane[36] is one of the first authors to consider the use of institutional theory to help understand the conditions giving rise to modern slavery. One reason, identified by Crane,[37] for the observed continuity of modern slavery in supply chains when more legitimate forms of business are available, is complexity of the organisational field around slavery, with its varied legal and illegal, formal and informal institutions. The complexity of supply chain arrangements and the lack of transparency about these assist management to hide the unacceptable practice of modern slavery.[38] It is argued here, in line with Crane,[39] that only when sufficient institutional pressure is brought to bear on enterprises and their governance will an appropriate foundation for the ending of the wicked problem of modern slavery be possible.[40]

Three institutional isomorphisms (or mechanisms) – coercive, mimetic and normative – are viewed as key to the institutional approach to changing corporate behaviour.[41] The coercive mechanism of change is legally sanctioned, for example, by legislation or contract; the mimetic mechanism is morally governed by management; the normative mechanism is culturally supported.[42] Lack of awareness of these mechanisms and how they combine in global projects, such as ending modern slavery in operations and supply chains,[43] might lead to unexpected costs when regulative, cognitive-cultural and normative institutions are misunderstood.[44] We argue that institutional theory as developed originally by DiMaggio and Powell[45] provides the most logical foundation for analysis of modern slavery disclosures as it is the coercive, mimetic and normative pressures that are

30. Feasley, 2016, p. 17
31. Chuang, 2015
32. Chen and Bouvain, 2009
33. LeBaron and Rühmkorf, 2017
34. New, 2015
35. United Nations, 2018
36. Crane, 2013
37. Crane, 2013
38. New, 2015
39. Crane, 2013
40. Guthrie and Dumay, 2021
41. DiMaggio and Powell, 1983
42. Scott, 2008
43. United Nations, 2018; International Labour Organization, 2018
44. Orr and Scott, 2008
45. DiMaggio and Powell, 1983

FIGURE 1



needed to build awareness and encourage a change in the mindset of management and institutional structures (see Figure 1).

Literature lends support to the idea that national and international institutions have the potential to reduce modern slavery through coercive means that are legally sanctioned. Legislation about criminality and the rights of victims when slavery is discovered is complemented by compulsory disclosure in supply chains of certain companies as a means to encourage better corporate behaviour.[46] While Feasley[47] argues 'the international regulation regime plays a vital role in giving a global platform for increased education and awareness and idea development about the need to remove forced labor from supply chains', Crane[48] accepts the potential influence while pointing out the varying effectiveness of coercive sanctions.

Normative and mimetic institutional pressure on enterprises to eradicate modern slavery can emanate from industry and professional associations and peer groups. These groups, such as the ICMM[49] and Minerals Council of Australia, introduce standards and codes encouraging companies to behave in a virtuous manner in relation to workers using multiple 'nodes of networked governance'.[50] Fleischman and Tyson[51] also identify another possibility represented by the past role of the accounting profession in encouraging conventional slavery through the monetisation

46. Wen, 2016
47. Feasley, 2016, p. 23
48. Crane, 2013
49. International Council on Mining and Metals
50. Braithwaite, 2006, p. 885
51. Fleischman and Tyson, 2004

and commodification of the worth of slaves. This normative institutional pressure can equally be attributed to the development of modern slavery and acts against virtue. Hence, in practice, normative pressure can be viewed as an under-theorised and under-explored double-edged sword.

In summary, problems of removing modern slavery practices are multiplied because of the invisibility of the victims and the potential ineffectiveness of a single institutional solution, such as banning modern slavery through coercive means, or as a minimum making modern slavery practices more transparent, which requires a full mix of coercive, normative and mimetic policies to take companies beyond compliance.[52] The convergence of pressures to eliminate modern slavery based on different institutional isomorphisms and incentives seems to be a necessity where the rule of law holds, but not necessarily in undemocratic states where corruption is high. Analysis of the disclosed practices of mining companies in this regard provides a stepping stone to further understanding current practice in the developed country institutional milieu and what can be learnt about the potential from these influences.

The following section considers the research method used to investigate modern slavery disclosures in the UK and Australia's largest listed mining companies.

RESEARCH METHOD

The sample used for this research comprises 20 large mining companies, the ten largest listed on the Australian Securities Exchange (ASX) and the ten largest on the London Stock Exchange (LSE) by way of market capitalisation as of 31 December 2017 (see Table S2, supplementary material). This sample was selected for several reasons. First, mining is recognised as an industry in which modern slavery is found to flourish because it occurs in isolated regions insulated from law enforcement and others, such as unions, that might help protect individuals[53] and can involve intense manual labour.[54] Second, legislation introduced in Brazil, California, the United Kingdom, the European Union and France has introduced required reporting for defined large companies.[55] Third, leadership in developing new reporting systems is often associated with the largest companies in an industry, because these companies have available, and can commit, the specialised resources needed for inspection and reporting.[56] Finally, the largest mining companies have multinational operations and global supply chains in which modern slavery risks can occur.

Mining companies in Australia and the United Kingdom were chosen to compare at the end of 2017 because the UK is cited as the first country in the world to introduce compulsory reporting on modern slavery,[57] and Australia was about to introduce similar legislation (the *Modern Slavery Act, 2018* (Cth)) to that in place in the UK. Nonetheless, the psychic and cultural distances between the countries are relatively small, although differences exist, and managers claim these are under-estimated.[58] In addition, of the largest mining companies considered, three, BHP Billiton, Rio Tinto and South32, were listed on both the ASX and LSE, relating to the close cultural and historical connection between the two countries. Hence, the cross-listed companies provide a helpful third point of comparison.

A set of the public required and voluntary disclosures as at 31 December 2017 was examined in the context of identified coercive, normative and mimetic institutional influences. Information about

52. Quirk, 2006
53. Crane, 2013
54. Feasley, 2016
55. New, 2015; Baumann-Pauly et al., 2013
56. Business & Human Rights Resource Centre, 2017b
57. UK Government, 2018
58. Fenwick et al., 2003

modern slavery disclosures for each company was identified from their websites. Where in-site search functions were present, the following terms were used to identify initial areas of interest: 'slavery', 'human rights', 'forced labour', 'child labour' and 'labour' (applying both American and British spelling). PDF documents were downloaded in total, and non-downloadable information was cut and pasted into a searchable Word document. Links contained within the pages identified from the initial word search were checked using a snowballing process until all relevant information was obtained (Table 1 below).

All data obtained during the data collection phase was uploaded and coded using NVivo Pro version 11. Qualitative thematic analysis was used to explore the data, although some primary forms of quantification were used to complement the analysis as needed. Data were analysed in line with the different forms of isomorphism incorporated within institutional theory, which was then complemented with an analysis of disclosures based on different modern slavery-related topics. Additional insight was gained by analysing the disclosures inductively.

FINDINGS

Analysis of the disclosures made by the UK and Australian listed mining companies reveals an interesting institutional dynamic concerning how organisations respond to the coercive pressure of modern slavery legislation and how the different forms of isomorphic pressure are passed down to other companies in the supply chain and translated in different coercive, normative and mimetic ways.

Results reveal that the introduction of the UK Modern Slavery Act 2015 positively affected how the UK-listed mining companies report on modern slavery. Each of the UK-listed mining companies except one, Hochschild Mining plc, and the three cross-listed entities, include a stand-alone Modern Slavery Statement on their website stated as being in line with UK legislation, approved by the board and signed by a director. This indicates commitment, clear accountability and accessibility to information. The situation in large mining company disclosures can be contrasted with the fact that compliance with modern slavery legislation has previously been shown to be lacking in most UK companies required to report, with only half of them reporting and under 20% of registered

TABLE 1. SOURCES OF DATA

INFORMATION SOURCE	NO. UK LISTED COMPANIES n=10	NO. AUSTRALIAN LISTED COMPANIES n=10	AUSTRALIAN CROSS-LISTED COMPANIES n=3
Website data – MS specific – non-downloadable	7	5	3
Modern Slavery Statement	9	3	3
Code of Conduct and/or Ethics	9	8	3
Separate Human Rights Policy/Statement	2	4	1
Supplier Code of Conduct	5	4	3
Sustainability or CSR Report	8	7	3

Modern Slavery Statements meeting these basic requirements.[59] The evidence suggests, at least in the context of the top mining companies, that modern slavery legislation has a coercive effect relative to others falling under the Act. Nevertheless, these mining companies are going beyond the minimum requirement for compliance in which zero action is acceptable.

Indeed, the UK mining companies generally report on three of the Act's suggested content areas – engagement in due diligence, supply chain risk and assurance assessments and training concerning modern slavery. Of note is the explicit focus on modern slavery and modern slavery-related areas in the disclosures made by the UK-listed companies. For example, reference is made to specific areas included in definitions of modern slavery, such as forced labour and child labour, with action taken to minimise the risks in each area. Table S3 (supplementary material) provides sample quotes and demonstrates the coercive effect of UK legislation.

Figure S1 reveals UK-listed companies and cross-listed companies were more likely than companies listed solely in Australia to be taking specific action in relation to different topics associated with modern slavery.

Normative influences are evident in both samples (see Table S3). Guidelines from extra-organisational bodies such as the United Nations Voluntary Principles on Security and Human Rights and the United Nations Global Compact are referred to by about half the sample, with an even distribution between the UK and Australian companies. The International Labour Organization (ILO), with its voluntary labour standards, is also mentioned by several companies from both samples, albeit the role of this organisation is not prominent. Against the normative tendencies, it is anomalous that the Global Reporting Initiative (GRI) as a normative basis for reporting is mentioned by a larger number of Australian than UK companies. Aspirational language tends to be used in relation to these voluntary principles and standards rather than focusing on actual practice. To a lesser extent, industry bodies such as the Association of Mining and Exploration Companies are also mentioned as a normative source of guidance on disclosures.

The UK sample is more specific concerning action taken to ensure that normative principles are translated into practice. A summary of typical normative aspirations and actions is contained in Figure S1 (supplementary material). Aspirational language is used by most companies with generic and non-specific statements such as '[Oz Minerals is committed to] Not employing forced, bonded or child labour and supporting the elimination of child, forced and compulsory labour'[60] being typical. However, it is notable that the companies listed only in Australia do not appear to be moving beyond the aspirational position to complement it with specific processes and activities, the only exception being Fortescue Metals Group, which provides considerable information about modern slavery. This is taken up further in the discussion. The specific action taken, where mentioned, generally incorporates due diligence, supplier screening and audit, training (both in-house and within the broader supply chain) and other approaches aimed at building awareness, all topics suggested for voluntary inclusion under the UK Act. Sometimes this information involves quantification, as in the following example from Rio Tinto:

> **Our online human rights training including guidance around forced labour has been mandatory for all employees in Rio Tinto's Procurement function since 2014. As of December 2016, 96 per cent of all**

59. Business & Human Rights Resource Centre, 2018
60. Oz Minerals Annual Sustainability Report, 2016

> **Procurement employees had completed the training.**[61]

However, more often, disclosures involve descriptions of programs and initiatives representing an area for potential improvement for better transparency and accountability to be achieved.

About half the sample provides mimetic disclosures based on peer benchmarking in both countries to assist with comparison concerning company performance in respect of modern slavery governance. The crossover with normative pressures from industry associations is also noted, highlighting the interrelationship between the classificatory categories and the use of soft regulation to encourage greater self-regulation, especially in the early days of encouraging modern slavery disclosures as one tool designed to help build countervailing resilience in companies to resist or defeat pressures to adopt modern slavery practices.[62]

An analysis of disclosures against modern slavery themes highlights some new observations (Figure S1, supplementary material). In particular, little emphasis is given to bonded labour across all companies in the sample, yet this is a longstanding issue and key component of modern slavery.[63] Figure S1 (supplementary material) also reveals that Australian companies have much to do to catch up to their UK-listed counterparts in disclosures about aspirations and actual performance, with a single Australian company, Fortescue Metals Group, driving its results. Fortescue Metals Group is known for having a Chairman who actively engages in exposing modern slavery in its supply chains. Nevertheless, modern slavery continues as revealed in relation to the sourcing of the company's solar panels from a company in China known for its practice of modern slavery.[64]

Beyond this, analysis of the results also reveals evidence of how the UK-listed mining companies are transferring institutional pressures to other organisations and suppliers upstream in their supply chains. For example, training programs are often extended to include suppliers and contractors. As reported by Vedanta:[65]

> **This year, we provided more than 375,573 hours of training on Code of Conduct including Human Rights aspects.**
>
> **As part of our commitment to continual improvement, and going 'beyond legal compliance', we are currently working on rolling out an e-learning module... across the group and issuance of post-training e-certificates.**
>
> **Under the current framework implementation, we have put in place a system for training of vendors/ suppliers... The total coverage in terms of training is 78.9% with regards to contractors and regular employees.**

Although e-training could be classified as normative, the commitment to supplier training is often codified via supplier codes of conduct that extend to modern slavery and the protection of human rights, suggesting the further extension of coercive institutional pressure on others in the supply chain. Antofagasta similarly notes in their 2016 Modern Slavery Statement:

> **As part of the Compliance Model, due diligence is performed on all new suppliers before they are engaged and periodically thereafter. The due diligence process requires suppliers to complete a questionnaire**

61. Rio Tinto, 2017 Modern Slavery Statement
62. Crane et al., 2019
63. Quirk, 2006
64. AFR, 2021
65. Vedanta, 2017, Sustainable Development Report 2016–2017

> **explaining their compliance models, training programs, codes of conduct, processes for receiving and investigating complaints, third party background checks and compliance procedures for the prevention of slavery and human trafficking.**

This encourages suppliers to work with other normative and mimetic sources to monitor and improve their performance in this area. Combined with the analysis presented earlier, this suggests the catalytic impact of modern slavery legislation has the potential to extend beyond focal companies, as shown in Figure 1. Indeed, analysis of the disclosures suggests that many UK organisations are internalising institutional pressures, which then translate into new forms of coercive, normative and mimetic pressure placed on other organisations in their supply chain, as displayed in Figure 1.

Under the UK Act, the suggested information to disclose relates to the organisation's structure, business and supply chains. Several companies provide specific basic facts about their supply chains even though this is not mandated. For example, four of the UK and four of the Australian companies indicate how many suppliers they manage (Table S2, supplementary material). Two of these companies are cross-listed. No information was provided about the total number of tiers being managed.

To summarise the results, while the UK-listed mining companies and Australian companies cross-listed in the UK have responded to the coercive influence on disclosure concerning modern slavery legislation, non-cross-listed Australian companies are at an earlier stage of development. Indeed, two Australian companies, Evolution Mining and Mineral Resources, were marked by a lack of disclosure on human rights and modern slavery. Specific to modern slavery disclosures, the largest engaged Australian mining companies rely on human rights-related legislation with mimetic and normative institutional pressures supporting countervailing resilience to the institutionalisation of modern slavery in companies.

DISCUSSION

Motivated by a lack of prior research and arguments that institutional influences may operate differently in the context of modern slavery, this study sought to obtain exploratory evidence and analyse how coercive, normative and mimetic pressures are reflected in the UK and Australian listed mining company disclosures about modern slavery in direct operations and supply chains.

Coercion

Exploration of modern slavery disclosures of a set of the largest UK and Australian listed mining companies reveals the impact of specific modern slavery legislation. The observations from UK-listed company disclosures are in sharp contrast to those provided by the Australian sample, except for cross-listed entities subject to UK requirements, with evidence of direct coercive influence on modern slavery disclosures being largely absent in the Australian group. Nevertheless, human rights are also embodied in laws in the two countries and are coercive, being partly based on the United Nations Universal Declaration of Human Rights.

Although the human rights legislation applicable in the UK and Australia ratifies the International Covenant on Civil and Political Rights Article 8 under which 'no one shall be held in slavery, slavery and the slave-trade in all their forms shall be prohibited, no one shall be held in servitude, and no one shall be required to perform forced or compulsory labour' (as defined with some exclusions regarding military and prisoner populations),[66] Table 1 shows human rights legislation to have less influence on disclosures than the specific Modern Slavery Act. In this regard, based on the evidence presented, Australia appears to be a laggard. Given the sources of data on modern slavery issues available – ranging from

66. UNHCR, 1966

Modern Slavery Statements, through Supplier Codes of Conduct, to Sustainability Reports – non-cross-listed Australian companies have much work ahead of them. In the absence of Modern Slavery legislation, human rights legislation could account for the results showing that the most prominent Australian mining companies strongly emphasise general human rights (see Table S3 and Figure S1).

Normative

Concerning both samples, normative reference is often made to the UN Agreements on Human Rights, and it can be argued that this is seen as the minimum standard to be applied or used to demonstrate conformity with basic societal expectations. However, given the lack of detail provided about how compliance is achieved, especially by Australian companies not subject to UK legislation, the more skeptical might suspect this agreement is being used as a legitimising tool by the state and business, designed to demonstrate compliance. In contrast, actions within the company remain unchanged.[67]

The Australian mining companies appear to lag in relation to modern slavery disclosures and, by 2017, had not taken up the opportunity to be proactive and adopt the UK and cross-listed organisations' practices, which, as Table S3 (supplementary material) shows, were said to have been driven by the UK Modern Slavery Act 2015. In this regard, institutional mimetic pressures in the Australian setting appear ineffective. Indeed, only one Australian mining company considered the potential for legislation to be introduced in Australia to merit a stronger emphasis on modern slavery disclosures and that company, Fortescue Metals Group, had an individual leader in the movement against modern slavery as founder and Chair of the board of directors.

It appears that institutional pressures have worked to keep disclosures to a minimum in Australian companies. In 2017, in line with Crane's argument,[68] the Australian mining companies, by implication, appear to accept the view that either modern slavery is not essential and there is little need to report, or that, by default, silence on the issue strengthens the resolve of mining companies to accept and by default support the practice of modern slavery. Transformation from this situation needs normative acceptance that change is necessary, that options such as mimetic self-regulation exist with or without the threat of new regulation, and that the companies can change, starting with policy, after which a resource commitment is needed to weed out any instances of modern slavery in practice. Judging by disclosures made, what is needed and what has been missed by the Australian miners is the establishment of a countervailing resilience against modern slavery. Nevertheless, these poor normative and mimetic results, framed at best in aspirational terms rather than actions, are a powerful advocate for the introduction of legislated shaming of Australian companies into better practice because of impacts on their reputations – 'a fairly weak instrument for improving practices' but the best available.[69] Nevertheless, it is a paradox that shaming does not bring about leadership that encourages learning about how to change on this issue.

From the results, countervailing resilience against modern slavery has not been institutionalised through coercive, normative and mimetic pressures on the largest mining companies in Australia. Only one Australian company took the opportunity to make a difference, which appears to have been driven by personal objectives rather than institutional pressures. Fortescue Metals' Chair, Andrew Forrest, an active philanthropist and one of the wealthiest Australians, helped establish the

67. Siddiqui and Uddin, 2016
68. Crane, 2013
69. New, 2015, p. 703

Walk Free Foundation to combat modern slavery on a global level. The Walk Free Foundation is partly responsible for establishing the Global Slavery Index,[70] which builds awareness at a larger scale through country-by-country estimates of the number of people in modern slavery and actions of governments to eradicate the practice. His interest was driven by his daughter's experiences working with Nepalese orphans she believed were being trafficked into the sex industry and an awakened personal desire to seek assurance about whether there was slave labour in his business operations and global supply chain.[71]

Mimetic

Institutional theory predicts that organisations tend to mimic or copy the actions undertaken by large industry leaders in an attempt to appear legitimate in relation to areas of concern to society and emulate their success. Thus, it could be argued that Fortescue Metals Group and other UK-listed Australian companies previously required to report under the UK Act provide a powerful example for others to follow. However, the lack of action from the other Australian companies suggests that mimetic influences are weak in the absence of more substantial coercive pressure, and, implicitly, modern slavery is seen as unimportant. Alternatively, given the lack of specific action concerning modern slavery, mention of mimetic processes could be used as a decoupling technique designed to give the appearance of adhering to social norms while actual practice remains unchanged.

Implications for Policymakers

Governance through legislated disclosures and criminal sanctions are becoming the enabling and driving tools to change the behaviour of companies about modern slavery. Regulatory policymakers so concerned about modern slavery that they seek specific governance of the behaviour of companies can take solace from the results, which show that, relative to the more general approach of Australian mining companies, leading mining companies in the UK have responded to legislated disclosure requirements. Continuation of this policy in these developed countries framed by the rule of law is both reinforced and encouraged by these results.

Of the various groups espousing what companies should disclose about modern slavery, the Global Reporting Initiative and United Nations Global Compact dominate company discourse (Table S3, supplementary material). The two collaborate to build transparency about modern slavery[72] along with the Responsible Labor Initiative[73] and Responsible Mining Initiative,[74] although the latter is not acknowledged in the disclosures explored. Nevertheless, regulatory policy based on an information strategy of which disclosure forms a critical part could directly encourage the development of the disclosure and third-party audit activities of these extra-organisational bodies concerned with reducing modern slavery in supply chains.

In addition, in this global industry, governance through mimetic peer benchmarking pressures, which disclosures reveal is partly relied on in the Australian context, appears from the evidence to be relatively ineffective in driving actions to reduce modern slavery. There is scope for regulators to leverage these mimetic pressures by encouraging the necessary cooperative processes and procedures associated with peer benchmarking to combat modern slavery practices. As human rights policy statements are currently only provided by a minority of the larger, leading companies (Table 1), a first step would be to develop a regulatory policy that further uncouples modern slavery (policy) statements from human rights policy statements to build the countervailing power of

70. Walk Free Foundation, 2018
71. Miller, 2014
72. https://dfge.de/gri-and-ungc-partnership-on-the-sustainable-development-goals/
73. https://www.responsiblelabor.org/forced-labor-transparency-and-reporting/
74. https://www.responsiblemineralsinitiative.org/news/rmi-and-gri-launch-responsible-mineral-reporting-toolkit/

modern slavery disclosure that could otherwise by swamped by other issues.

Implications for Practice

Legislation in the two countries, the UK and Australia, relies on company reputation as the main driver to change behaviour towards resistance and abandonment of any inclination to adopt modern slavery practices in operations or to turn a blind eye to its presence in supply chains. Apart from the need to be proactive to gain a competitive advantage by going beyond compliance if reputations are not to be sullied, two aspects of the results will be of particular concern to companies. These relate to the non-disclosure of basic information about supply chains that is not required by legislation, and the normative need for assurance processes to be developed to add credibility to modern slavery information, encouraged by mimetic imitation practices by peers and industry associations.

Coercive guidance about reporting on modern slavery in supply chains is aimed at general systematic presentation of certain information. It is not mandated but forms an essential part of risk assessment. This information is not provided by most companies considering modern slavery in supply chain management.[75] Most of the largest mining companies sampled did not undertake full supplier mapping to identify the number of suppliers and the countries in which these are based. In addition, of the six companies examined that did reveal the number of their suppliers, most did not indicate how supplier numbers relate to different tiers or, indeed, the number of tiers of suppliers being managed in their supply chains. Again, this appears to be necessary data for high-level managers and external parties trying to assess modern slavery risks and how best to address them and is data that proactive companies would search out, manage and report.[76] In both countries, the evidence indicates institutional pressures are not effective in encouraging such disclosures other than in line with selected priority areas and tier 1 suppliers. Perhaps encouraged by literature that considers the optimal number of suppliers[77] and sub-supplier compliance with sustainability standards,[78] policy and practice need to be developed.

Related to this point is the absence of information about assurance of supplier information. Particular attention needs to be directed to the supplier audit process, including research identifying the best ways to audit and assure modern slavery disclosures and risk practices and identifying areas for improved management. For example, are supplier contracts cancelled, or is a softer approach to resolution implemented through increased training, resources support and rehabilitation of the supplier to help avoid the risk of the supplier going underground with another focal company? Empirical analysis of supplier contracts and Supplier Codes of Conduct and Modern Slavery Statements could show whether there is a phased approach to eradicating slavery or a 'one strike and you are out' approach and would reveal the relative success of each strategy for companies.

Scope for Further Research

Cross-sectional findings presented here suggest UK mining companies are relatively proactive in compliance with regulated modern slavery disclosures, compared with Australian mining company disclosures before implementation of specific modern slavery legislation. Future research includes the need for a comparative analysis of disclosures published over time, to ascertain whether companies reporting no issues did not

75. ICAR and FLEX, 2019
76. ICAR and FLEX, 2019
77. Ruiz-Torres and Mahmoodi, 2007
78. Grim et al., 2016

locate examples of modern slavery because they did not look hard enough and whether Australian legislation is more effective than UK legislation.

Normative pressures may mediate between legislated solutions and modern slavery disclosures and practices. The relative effectiveness of normative international and industry-based disclosure guidelines as complements or substitutes for government legislation also needs to be explored.

Debt bondage is relatively under-researched in the context of these mining companies. The results suggest that additional pressure of a voluntary nature, such as through the UN Global Compact, the ILO and the GRI, which contains guidance on debt bondage within its standard on Forced or Compulsory Labor (GRI 409), may have a complementary influence on companies concerning this specific issue, raising the question of the potential relative importance of international and national voluntary and mandatory initiatives.

The role of mimetic pressures on modern slavery outcomes also merits greater attention from researchers. Examination of when peer benchmarking succeeds and the factors behind success would interest government policymakers and businesses alike. Evidence indicates that peer benchmarking in the Australian companies has not encouraged them to catch up with the UK Act disclosure requirements.

Modern slavery and the efficacy of a disclosure-led governance regime to help address it are so new to academia that there are untold research opportunities that should help develop an understanding of how to promote disclosures that encourage countervailing resilience against the passive acceptance of modern slavery by a business.

CONCLUSION

Modern slavery is a problem for companies operating across international borders, with the UN and signatory countries targeting its elimination by 2030. Countries committed to ending the practice are tightening criminal legislation. In addition, several countries are using, or are about to use, an information disclosure strategy about operations and supply chains to change company behaviour.

This study explores what corporate disclosures about modern slavery in direct operations and supply chains tell us about institutional influences on a sample of the top UK and Australian listed mining companies, the minerals industry being an example of where similar cultures pervade and modern slavery has been found.

The institutional dynamic within the supply chain setting has not been explored in prior research and represents an important area for future study and a possible extension to existing approaches to institutional theory. In particular, results indicate that institutional pressures that encourage a countervailing resilience to the adoption of modern slavery are less effective than expected in the absence of specific legislation. However, the lack of action from Australian companies in the absence of legislation suggests that mimetic influences are weak in the absence of more substantial coercive pressure.

The results also reveal gaps in transparency that no institutional pressures, regulatory, normative or mimetic, have overcome. Also, disclosure about modern slavery in supply chains in the top UK mining and cross-listed companies examined does not appear to go far enough. Basic information about supplier numbers and tiers of sub-suppliers required for managing modern slavery is neither mandated nor voluntarily provided by the mining

companies. Furthermore, disclosures about some aspects of modern slavery, such as assurance processes about the credibility of statements and related debt bonded labour, are not sufficiently addressed in either country.

Although the observations reported here represent development in understanding the corporate response to institutional pressures related to modern slavery, they come with a caveat. In particular, it should be noted that the number of companies for which modern slavery disclosures were examined was restricted to the ten largest listed mining companies from each of the UK and Australia, and the results of this study must be considered in the light of this limitation. Nevertheless, this was not deemed problematic given the exploratory nature of the research and the need to develop a greater understanding of how to combat this scourge on contemporary society. Future research can extend understanding by considering other industries, countries and samples.

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ARTICLE

IT'S NOT ROCKET SCIENCE: HUMANITIES, ARTS AND SOCIAL SCIENCES IN THE SPACE SECTOR

Dr Basil P. Tucker & Dr Hank C. Alewine

The space industry is traditionally associated with STEM disciplines, but humanities, arts and social sciences have plenty to offer to the modern space sector. Space accounting scholars Dr Basil P. Tucker and Dr Hank C. Alewine investigate the potential of HASS to address the unique and unprecedented challenges of the New Space Age.

INTRODUCTION

Traditionally, the role of the humanities, arts and social sciences (HASS) in the space sector has been less apparent, less evident and less appreciated than science, technology, engineering and mathematics (STEM). Non-STEM disciplines such as politics, public administration, law, psychology, archaeology, project management, art, marketing, economics, accounting, finance and history are becoming increasingly influential to space exploration, research and policy, and can meaningfully contribute to all these aspects of the space sector. Our progress and achievements in space are influenced by our ability to bring together knowledge from many different disciplinary viewpoints – viewpoints that enable us to see, understand and solve the problems of space travel, exploration and, eventually, habitation. Although much of surmounting these challenges will require impressive technological, scientific and engineering achievements, advancements in space objectives and creating and growing a space economy are by no means the exclusive province of the STEM disciplines. The future advancements realised from overcoming unprecedented and daunting tasks

will involve teams of professionals synergistically mobilising both STEM and HASS disciplines.

In this paper, we investigate some of the cross-disciplinary approaches involving HASS disciplines that might more effectively contribute to solving the problems presented by the modern space sector (dubbed the 'New Space Age'). Note that in this paper, we use the term cross-disciplinary to generally encompass multi-, inter-, and trans-disciplinary research. We recognise that there are nuances between these specific types of research, but distinguishing between them is beyond the scope of this paper.

The data used are based on a larger project involving interviews with 21 current and former academics across the globe from a wide range of disciplines who work or have worked within the space sector. What was evident from these interviews was the repeated recurrence of three themes. First, HASS disciplines are perceived to hold an integral role in the New Space Age. Second, cross-disciplinarity is thought to hold many benefits. Principally, the thinking is that cross-disciplinary approaches are likely to address the complexity and unprecedented nature of problems encountered in the New Space Age in ways that are both innovative and creative, and in a fashion that meets the needs and expectations of stakeholders. Third, pursuing a non-conventional field of study as a HASS academic is not without its non-financial costs, these being: the (perceived) lack of credibility one suffers from not having a STEM background in what has been traditionally a STEM field; and pragmatic career considerations – primarily, the absence of a defined and established career path for individuals with a HASS background in this new arena.

The path to a New Space Age

Governments jointly expend about US$80 billion annually on space activities, while the overall space economy may be worth over US$387 billion.[1] This level of expenditure is coupled with several significant developments, such as the increasing engagement of private sector entities in the space economy,[2] lunar plans,[3] the prospect of launching a crewed mission to Mars,[4] and the increasing footprint of global space activities. Seventy-two countries now have active space programs, including 14 with launch capabilities.[5] All this forms what is currently termed 'the New Space Age'.

Another perspective involves the shorter label, 'New Space'. Here, the focal point of the sector has moved away from government agencies bearing sole responsibility for space-faring activities, shifting towards a number of private entities that now provide much of the leadership when it comes to achieving modern space objectives.[6] This shift in the composition and responsibilities of stakeholders opens up opportunities to advance space-related pursuits in previously impossible ways. For example, more competition from the private sector will not only lead to increased innovation in the technologies created for space applications but also help to develop entirely new streams of entrepreneurial activity within the sector, such as space tourism, space launch services and space mining endeavours.

This competition in New Space dynamics may consequently lead to advances that all stakeholders might benefit from. For example, the costs of launching a rocket might be streamlined, making space more accessible to everyone.[7] We might

1. Cross, 2019
2. Crawford, 2021
3. Migaud et al., 2021
4. Kalmbach and Ralston, 2021
5. Cross, 2021
6. Weinzierl, 2018
7. Alewine, 2020

deepen our understanding of how management controls and creativity can coexist in entities that are dependent on innovation.[8] Or we might learn more about how the psychological and sociological factors of New Space impact organisational behaviour and its human involvement. This includes both workers within the space sector and the general public as they emotionally process the consequences of human ventures off Earth and into outer space. Such knowledge creation and its applications will rely heavily on cross-disciplinary efforts, particularly from HASS disciplines. However, for this to materialise, the literature needs to provide insights into how such cross-disciplinary efforts come to fruition in New Space. We aim to help build the literature in this regard.

All of the above developments suggest that space exploration will proceed. This is even though humanity has not ventured beyond low Earth orbit since the original Moon landings of the late 60s and early 70s. This is not an unreasonable assumption since, in the intervening period, we have landed probes on Mars and Venus, conducted fly-bys of the outer planets, built and flown reusable spacecraft, and observed the cosmos via the Hubble Space Telescope. More recently, the James Webb Space Telescope travelled through interstellar space like Voyager 1. Now, we are witnessing the commercial sector become a key player in space by exploring resource mining, tourism, colonisation and national security operations. As we head into the second decade of the 21st century, space activities are increasingly becoming the vanguard of research, development and the global economy.

Mars – a different proposition than landing on the Moon

Most space exploration endeavours in the recent past have been robotic missions. However, now plans are being made to transport humans to Mars by 2033 – a human achievement that might rival the Moon landing.[9] Yet accomplishing such an endeavour will present complex and unique challenges that will test the limits of human ingenuity and organisation. Moreover, overcoming these trials will extend our resourcefulness beyond the considerations many would think of first – that being the scientific and the technological. In fact, there are many other implications of space exploration and its related challenges that need to be resolved, be they ethical,[10] legal,[11] financial,[12] medical,[13] political,[14] environmental,[15] or related to public opinion.[16] Individually and collectively, these challenges represent potentially significant impediments toward a human presence on Mars. For all these reasons, at present, human interplanetary missions not only remain beyond our technological and medical capabilities, they also exceed our social, political, financial, psychological and sociological talents. These considerations represent cogs of a larger, more complex dynamic that must be addressed, acknowledged and resolved before meaningful modern space sector strategic objectives can be realised.

Cross-disciplinarity as a way forward

Overcoming the challenges of the New Space Age will involve often-conflicting perspectives between stakeholders, such as policymakers and private enterprises, entrepreneurs and workers, public sector agencies and private sector organisations. Research and policy circles

8. Tucker, Halkett and James, 2021
9. Szocik, Lysenko-Ryba, Banaś and Mazur, 2016
10. Arnould, 2019
11. de Zwart, 2019
12. Ehlmann et al., 2005
13. Saluja et al., 2008
14. Moltz, 2019
15. Mankins, Mankins and Walter, 2018
16. Kalmbach and Ralston, 2021

increasingly acknowledge that such issues cannot be resolved by any lone discipline independently[17] but, instead, will necessitate alliances, solid cooperation and transparency between an array of researchers and practitioners across multiple disciplinary boundaries.[18] Thus, modern research commonly calls for cross-disciplinary tactics to solve these challenges.[19] However, communicating across disciplines and overcoming the 'silo' mentality so common to research, especially within the academy, has been notoriously difficult to accomplish. This is a significant hurdle on the path to realising the benefits that cross-disciplinary endeavours might provide.

Thus, cross-disciplinarity is not a strange idea nor a tactic to advance research policy either generally[20] or specifically, given arguments advocating the necessity of interdisciplinarity in space and planetary sciences.[21] Over the past three decades, there has been a noticeable increase in the emphasis placed on encouraging cross-disciplinary alliances among various STEM and HASS fields within research policies and funding mechanisms worldwide.[22] Further, there is growing acknowledgement in the literature that the research challenges we face are of such a magnitude that any solutions will need to rely on knowledge created out of a vast range of subjects, some of which we have traditionally perceived as being quite distant.[23] And, moreover, these complicated endeavours are only anticipated to increase in the future, resulting in even more necessary interactions amongst once disparate fields of study.[24]

At first, the above trajectory of complexity in future research seems perplexing in view of the various potential combinations of disciplines that might work together, and the different forms that cross-disciplinarity might potentially take.[25] Thus, cross-disciplinarity may be something of an umbrella term for associated ideas that essentially cut across disciplinary boundaries[26] or, as Schmidt[27] notes, 'problem orientation beyond disciplinary constraints'.

Cross-disciplinary approaches have been examined in a range of environments and contexts involving HASS and STEM.[28] Over the past few decades, more credence has been given to cross-disciplinary methods and, more specifically, cooperative approaches and cross-field understanding.[29] Alexander and Bannova,[30] for example, consider cross-disciplinary research to be vital to future successes in researching, policymaking and actual exploration within the space sector. However, there are very few formal investigations of meaningful, effective and unique cross-disciplinary approaches in the literature. In exploring the perceived hurdles that see cross-disciplinary approaches cast to the sidelines in the New Space Age, we aim to offer tangible views supporting the value proposition that HASS disciplines can help to solve the wicked problems of the modern space sector.

17. Brown et al., 2010
18. Hawkey et al., 2019
19. Ryan and Neumann, 2013
20. Siebert et al., 2020
21. Berea et al., 2019
22. D'Este et al., 2019
23. Cummings and Kiesler, 2014
24. Davies et al., 2018; Lyall and Meagher, 2012; Sardar, 2010
25. Van den Besselaar and Heimeriks, 2001
26. Klein, 2012
27. Schmidt, 2011, p. 249
28. Metcalfe et al., 2006
29. Lee et al., 2018
30. Alexander and Bannova, 2021

The potential merits of cross-disciplinarity within the space sector align nicely with the 'Second Track' process of the Global Access Partners' (GAP) Australian Space Initiative.[31] The 'Second Track' process was designed to'bring together experts from relevant sectors including government, business, non-government organisations and consumers. Working collaboratively, with a positive approach, these groups identify problems, initiate discussions, prepare papers, develop practical solutions and oversee their implementation'.[32] This is the very definition of cross-disciplinarity – collaborations between a multitude of experts, such as academics, researchers and practitioners, in a wide variety of disciplines from across the scholastic spectrum working together to solve complex space-related challenges.[33]

The importance of HASS to the space sector

In the past, researchers and practitioners in HASS disciplines have sometimes found it difficult to effectively communicate the value they can provide in areas that are generally considered to fall under the purview of STEM disciplines.[34] As a counterpoint, though, some space organisations have noticed the potential value of HASS in achieving space objectives. One example is the European Space Policy Institute, which notes that HASS contributions will be integral to future achievements in space.[35] Pell[36] also notes that various HASS areas, such as archaeology, sociology, tourism and law, can play a meaningful role in advancing the space sector. She suggests that HASS disciplines tend to provide frameworks and methodologies that work to cultivate a better understanding of how people will engage with 'space technology, systems and environments' and that this will impact all aspects of establishing and achieving strategic space objectives.

Perhaps a starting foundation to both consider and emulate for cross-disciplinary engagement by HASS disciplines in the space sector is NASA's Human Research Program. This research and technology program, which began in 2005, initiated procedures to manage NASA's research on the substantive elements of human health and performance risk during space exploration.[37] The program acknowledges five key risks of spaceflight: 1) decreased gravity (including gravity transitions and launch and landing loads), 2) increased radiation, 3) a hostile/closed environment (including habitability factors such as atmosphere, microbes, dust, volume/configuration, displays/controls), 4) isolation/confinement and altered light-dark cycles, and 5) distance from Earth. Of note is that only two factors on this list (decreased gravity and increased radiation) would presumably fall almost exclusively within the realm of STEM disciplines. For overcoming issues related to the other factors (hostile/closed environments, isolation/confinement and altered light-dark cycles, and distance from Earth), the program enlists the help of researchers and practitioners from HASS disciplines, such as psychology, organisational behaviour, project management and financial management. Of course, many other HASS disciplines might be similarly involved in neutralising such hazards. Just a few moments' thought should bring to mind the incredible range of subject matter deliberations and reflections needed to plan, research, develop and execute solutions to the myriad components of a space mission. Even disciplines generally considered

31. Global Access Partners, 2017
32. See 30
33. Fritz and Mallory, 2022; Fritz, 2019; Massingham, 2019; Fritz-Kalish, 2019
34. Ankeny and Given, 2018
35. ESPI, 2007
36. Pell, 2021, p. 5
37. Smith et al., 2020

to offer only behind-the-scenes support might be heavily involved with achieving space objectives – disciplines like *accounting*! [38]

On the surface, it makes sense that undertaking these missions would involve a diverse range of subject matter. For example, consider the tasks and short-term goals needed to successfully fly for eight months to reach Mars, let alone the additional plans needed to stay there for an extended time before returning to Earth. Attempting such lengthy missions will involve solving economic, health, psychological and managerial challenges on rarely experienced or appreciated levels. It is clear that a better understanding of the nature and extent to which HASS-related cross-disciplinary approaches can meaningfully contribute to overcoming these hurdles is in order. To this end, we have undertaken a study that aims to identify the factors that surround the potential contribution of HASS-related cross-disciplinarity to the unique and largely unprecedented challenges presented by the New Space Age.

METHODS

Study participants

The study's participants were selected to capture a diverse set of perspectives on the applicability of cross-disciplinarity in the New Space Age. Our overarching selection philosophy followed Parker and Northcott who argue that the participants should be those 'that can best inform the focus of their inquiries and provide the in-depth information relevant to the study's research question'.[39]

Consequently, our sample comprised 21 academics, predominantly from HASS disciplines, from a space research group within a leading Australian university. Comprising scholars from around the globe, including Australia, the US, the UK, China, Italy, Canada and India, the broad mission of this research group is to bring a humanities, arts and social sciences perspectives to the space sector through research, education and consulting. The strategy in selecting these individuals was to bring together a diverse set of academics with multidisciplinary and multilevel perspectives and a range of interests in space matters beyond traditional STEM boundaries. The disciplines represented included finance, accounting, law, ethics, project management, organisational behaviour, marketing, strategy, public sector management, history and archaeology. The experiences of these interviewees help provide quality insights into the ways and means by which cross-disciplinary efforts can address the contemporary challenges presented by the New Space Age.

Data collection and analysis

The data were gathered through semi-structured interviews. The interview questions were designed to help direct the discussions and so were deliberately general and open-ended. This gave the interviewees significant discretion as to the level of detail provided, which helped to capture their genuine views on the subject matter.[40] The questions revolved around our key topic of interest – the hurdles that may prevent the potential value that cross-disciplinary approaches can add to the New Space Age from materialising, particularly those that involve HASS disciplines. The interviewees were asked to provide their opinions on the broader characteristics of cross-disciplinarity as it relates to challenges in the space sector. This method allowed the researchers to consider what the interviewees felt was meaningful without introducing demand effects. It also helped ensure that the data reflected an experience-based view on the part of the participants instead of accidentally involving any preconceived biases the interviewers may have had.

38. Alewine, 2020; Tucker and Alewine, 2022
39. Parker and Northcott, 2016, pp. 1116
40. Kvale and Brinkmann, 2009

The interviews were conducted via Zoom due to the logistical and health considerations stemming from the COVID-19 pandemic. They lasted between 45 and 90 minutes and were audio-recorded. The research team took notes during the interviews. Afterwards, the interview recordings were transcribed and coded in the qualitative software package NVivo. This method efficiently captured specific quotes based on guided search criteria that helped factor out both common and unique themes for consideration and analysis.

Our research procedures included approaches to help confirm 'credibility' and 'dependability',[41] and also to ensure that the processes of data capture, recording and reporting were authentic and genuine.[42] Steps to enhance credibility comprised peer debriefing, with the research team analysing the data as it developed to validate the themes and configurations that emerged. Actions to enhance dependability included transcribing interview notes, preserving the interviewees' contact records, and consistently documenting interview dates, times and venues.[43]

WHAT DID WE FIND?

Our findings are structured around three predominant themes that emerged from our interviews. The first theme concerns the integral role that HASS disciplines are perceived to hold in the New Space Age. The second theme relates to the perceived benefits associated with cross-disciplinarity, and the third theme relates to the perceived costs associated with cross-disciplinarity. These themes are illustrated through the 'voices' of the participants. The quotes reported highlight their primary concerns, uppermost observations and principal experiences. They also represent the consensus of the sample.

The role that HASS disciplines are perceived to hold in the New Space Age

The view that HASS disciplines have significantly contributed to the space sector in the past and will likely contribute more so in the future was unanimous. All interviewees, irrespective of their disciplinary background, location or university affiliation, perceived that the extent and nature of the contribution HASS disciplines have made to the space sector has been highly significant. Regardless of how the interviewing question was phrased or how the data were sliced and considered, there was broad consensus among the interviewees that 'HASS in space' is not a fleeting fad – it has staying power and will continue to contribute substantially to space objectives. In the words of one interviewee:

> I see the role of HASS disciplines in the space sector as very similar to the common analogy of the duck gliding across the water. To the observer all appears to be calm on the surface, but under the water, the duck is paddling furiously to stay afloat. You don't see what's under the water, and you don't see the influence of non-STEM disciplines in space activities – like marketing, management, financing, politics, teamwork, psychology. I6

The issue of disciplinary visibility was raised repeatedly in our interviews:

> The rocket launches and live streams from space is what is most visible – that's all STEM-related. The budgets, public relations, supply chain negotiations, political lobbying, and human resource issues are all HASS-related – that's what you don't see. I9

41. Lincoln and Guba, 1985
42. Parker and Northcott, 2016
43. Gelman and Basbøll, 2014

The widespread interest in space from disciplines other than science and engineering was an observation made repeatedly by the interviewees:

> You might say that to a hammer everything looks like a nail and that members of this research group are bound to say that HASS has a central role in space. That's the very point though – this research group, which brings together disparate non-STEM based disciplines, has a single common denominator – space. This is the tip of the iceberg insofar as interest in and contribution to space is concerned. I7

Several participants remarked on how the need for a HASS contribution to space has changed over time:

> When you are looking at longer expeditions (like heading for Mars) you have an entirely different ball game – the need to address team dynamics, supply of resources, commodities, psychological issues from being in an artificial environment for so long, the massive financial expense, and managing public expectations are going to be much greater than when we were headed for the moon. I9

This theme of now being a 'different ball game' to the demands of the past was pronounced in the interviews. The participants spoke of the very different demands presented by the New Space Age in comparison to the old days of Moonshots, and how this new context was not only shedding light on the benefits of cross-disciplinary approaches but also necessitating them.

The perceived benefits of cross-disciplinarity

Three perceived benefits associated with cross-disciplinarity were repeatedly stressed in the interviews. First, there was the opportunity to draw on a wide range of disciplines. This was seen to be most amenable to solving what were regarded as the 'wicked problems' the New Space Age presents. One interviewee explains:

> You could say the problems facing us in travelling to Mars fit the definition of wicked problems. They are highly complex, defy complete definition, are intractable and very difficult to formulate and manage. They can't be easily solved by any one discipline but require partnerships beyond traditional disciplinary boundaries. That's why a cross-disciplinary approach is necessary. We'll need all the resources available to us to solve these problems. I8

Second, and expanding on the above benefit, combining diverse disciplines in cross-disciplinary approaches increases our capacity for innovation and creativity. This was perceived to be a particular strength:

> Solving complicated and unprecedented problems will require creativity and innovation. A different perspective is likely to lead you down the creative and innovative path. I12

Another interviewee provided a different view of how diverse disciplinary lenses might contribute to more effective outcomes:

> What is reassuring about the involvement of a diverse range of disciplines is that different vantage points help you to see what's there – and not just a blinkered view of things. I17

The third benefit cited by the majority of interviewees related to diversity – that is, the more 'political' and pragmatic considerations of managing stakeholders' expectations:

> Stakeholders in the area of space are not passive observers – they have agendas and need to be convinced that things are running to their view of what the plan should look like. These expectations need to be managed. I14

When considered, these three benefits represent variations on a theme, which is that HASS disciplines are well equipped to help solve wicked problems synergistically. They can help space missions succeed by effectively navigating the human dynamics associated with space-related frameworks, technologies and organisational behaviours.[44] Similarly, it is well established in the literature that cross-disciplinary approaches can, through diversity, increase innovation and creativity.[45] Cross-disciplinarity capitalises on the diversity of experiences[46] and ways of knowing[47] to support creative and innovative outcomes.[48] This perspective is particularly applicable, given the wide variety of stakeholders working in the space sector, both public and private, that require specialist knowledge – for example, when manufacturing and managing space infrastructure and systems, in space-related R&D, and when developing public policies about space activities.[49]

The perceived costs associated with cross-disciplinarity

The costs of taking a cross-disciplinary approach, as recounted in the interviews, converge on two main themes: the loss of credibility when operating outside the STEM disciplines, and pragmatic career considerations.

The interviewees perceived that a lack of STEM training was detrimental to being accepted as a valued contributor to achieving space-related goals. One interviewee used the analogy of a hierarchy of disciplines in which STEM was rated more highly than HASS:

> There's definitely a hierarchy of disciplines in effect. Where space is concerned, sciences are the gold standard. Arts and humanities are nowhere near as prestigious or highly regarded – and are not always seen to bring much of consequence to the table. I11

Another interviewee reinforced the 'second-class citizen' observation and its implications:

> Without a science or engineering background you won't have much credibility. Social sciences, arts, humanities – anything that isn't technologically linked will have questions surrounding its credibility. I16

Still another interviewee identifies the potential downside of not developing a degree of credibility:

> Not only are people not accustomed to dealing with others who don't have a strong knowledge and understanding of the science of space, they won't take those without this understanding seriously. There are as you can see, turf issues at play. I21

In terms of career considerations, there was definitely a feeling that working as a HASS academic in this field meant one was giving up a defined and established career path. One participant offered a cautionary note on the practical difficulties of HASS researchers working in a STEM field:

> Non-STEM researchers who do research in STEM areas run the risk of isolating themselves from their original discipline, their peers, their funding sources, and their publication options. It's very high risk. I18

And these costs are amplified for junior and early-career researchers:

> Non-science-based researchers trying to forge a career in a science field is a very tall order. It hasn't been done a lot; the precedent has not been set yet. I19

44. Pell 2021
45. Zhang, et al., 2018
46. Davies et al., 2018
47. Kaufmann and Tödtling, 2001
48. Acar et al., 2019
49. Clark et al., 2014

The perspectives surrounding these costs are consistent with other views that advocate a more cross-disciplinary approach to research.[50] Thus, the reported issues that may currently hinder HASS disciplines from helping to advance the space sector are not unique. This is encouraging news in that, while not perfectly correlated with other challenges found in other contexts, there may indeed be 'lessons learned' from previous studies that can help HASS disciplines to address these costs going forward. What those detailed solutions may look like is not readily apparent. However, with the interviewees agreeing with the overall potential for HASS disciplines to meaningfully contribute to the space sector, future efforts to justify these costs seem very reasonable.

CONCLUSION

In this study, we explored the nature and extent of the contribution that HASS-related cross-disciplinarity might make to resolving the challenges of the New Space Age. From our interviews, it is clear that cross-disciplinarity – and, in particular, the role of HASS in the space sector – plays a prominent role. HASS disciplines can contribute much to advancing space objectives, as our sample of those working in the sector revealed. However, for the academics involved, it also comes at a cost.

This study delivers some notable contributions to the literature. First, the extant literature provides scant insight into how HASS disciplines meaningfully and positively impact strategic space objectives. The findings of this study can be seen as a call for all involved in the sector to reflect more on HASS's potential to help accomplish space objectives going forward. The understated HASS developments of prior decades have laid solid ground from which to develop and execute future space projects. Second, the data suggest the potential for a mutually beneficial partnership between the STEM and HASS fields in the space sector. Finally, the interview data focuses on people as being vital to realising the ability of HASS disciplines to advance space objectives, as opposed to the systems, policies and institutions at play in the sector. This includes a better understanding of how people can overcome complex challenges using their various areas of expertise while navigating the intricacies of the dynamics between stakeholders.

The social implications of having a better understanding of how cross-disciplinarity efforts advance space activities and research abound. Since humanity considers Earth to be its one and only home, the very idea of expanding the only boundaries we have ever known cannot be understated or taken lightly. Why are we pushing these boundaries and extending into space? What are the benefits and costs of the various courses of action we might take for society? And how will we get feedback on the consequences of those actions to inform future plans? With no predetermined trajectory on how to advance development in such a unique sector, it would be prudent to debate multiple perspectives from multiple areas of inquiry. As a result, there is no shortage of opportunities in HASS disciplines to consider when looking for ways to help advance the modern space sector.

Like other studies involving interview data, limitations exist that may impact the study's suggested inferences, but these present opportunities for further research. First, the method used to collect, organise and report the interview data is not immune from subjectivity. Although care was taken to mitigate this possibility, some of the data may be skewed due to misunderstandings between the interviewers and interviewees. If so, this would result in biased inferences. Also, given the lack of extensive analysis, this study is mainly exploratory in nature. This approach should not be surprising in a cutting-

50. E.g., Ashby and Exter, 2019; Pye, 2018; Taebi et al., 2014

edge area of academic inquiry, and, for this reason, we welcome critical analysis and further dialogue on the subject matter of the study. It is our hope to arrive at a more informed perspective on the state of the New Space Age and the potential for integrating HASS disciplines more thoroughly within it. Lastly, the newness of the setting may contain variables and contexts that warrant further investigation so as to enhance this study's internal and external validity. Such inquiries can only further strengthen the initial underpinnings of this exciting new area of space scholarship.

ACKNOWLEDGEMENTS

The authors would like to acknowledge the interviewees who participated in this study for their views which have informed this paper. We also would like to acknowledge the attendees of research seminars at the University of South Australia who provided extensive feedback on previous versions of this paper and two anonymous reviewers for their constructive and insightful comments. The analysis represents the opinions and arguments of the authors only and does not reflect the official views of agencies or institutions of the individuals who participated in the study.

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ARTICLE

DYNAMIC DECISION MAKING UNDER UNCERTAINTY: A BREHMERIAN APPROACH

Dr Erik Bjurström and Dr Bjørn T. Bakken

Scandinavian researchers Erik Bjurström and Bjørn Bakken discuss the contributions of the late Professor Berndt Brehmer to the study of dynamic decision making under uncertainty. His approach viewed decision making from a process perspective, framing decisions as events or expressions of an ongoing design process which expands possibility spaces rather than limiting decision making to pre-existing alternatives.

INTRODUCTION

The purpose of this article is to discuss the late Professor Berndt Brehmer's theories on dynamic decision making under uncertainty, thereby also problematising decision making and human rationality from the perspective of uncertainty. While implied in early work in psychology and in the pedagogy of pragmatism, as well as in Simon's notion of 'bounded rationality', uncertainty in decision making was explicitly addressed through Kahneman and Tversky's 'prospect theory' and later developments in behavioural economics. Recent research efforts have further explored decision-making processes per se, considering them in the context of their environment and exploring their relationship with uncertainty. Brehmer's approach to decision making under uncertainty is consistent with this evolution, from conceptualising 'dynamic decision making' as a series of decisions in which sensemaking is central in 'the dynamic OODA-loop' to seeing decision making as a matter of 'design'. In the context of networked command-and-control, Brehmer's theorising in the pragmatist tradition stands out for both its cleverness and practicality.

While many others focus only on information management or the riddle of structural properties of organising in a networked world, a Brehmerian approach deals with the shifting and emergent properties of such a world.

UNCERTAINTY AS IMPLIED AMBIGUITY

Decision making is undeniably central to economic theory, relying on the assumption of rational, utility-optimising individuals. Simon's (1947) observation of the consequences of humans' limited span of attention echoed and further explored in organisational settings the fundamentals of psychology as presented by William James (1890), where attention and the flow of experience – rather than rational optimisation – was at the core of the theory.[1,2] For James, Peirce, Dewey and other adherents of American pragmatism, reflection on the fundamentals of psychological experience was simultaneously an exploration of pedagogy and of the philosophy of science. This trinity of overlapping fields of knowledge was broken by the advent of logical positivism within psychology, eliminating introspection for the sake of scientific ambitions of behaviourism in the early 20th century, reintroduced as meta-cognition in the late 1970s.[3] Simon's findings became associated with the notion of 'bounded rationality', which is interpreted in an overly pessimistic sense of humans being somewhat irrational,[4] or simply making bad decisions.[5] While uncertainty was not explicitly addressed through the notion of 'bounded rationality', it was implied that selective attention might generate different foci and, thus, ambiguity in different observers' perceptions and accounts of one event.

UNCERTAINTY AS AN EXPLICIT ASPECT OF TIME

Kahneman and Tversky's (1979) prospect theory[6] emphasises uncertainty in its empirically founded criticism of economic theory's notion of 'expected utility' as the basis for decision making. Their experiments instead showed how emotional tendencies, for example, risk aversion, influence decisions under uncertainty. Of crucial importance here is the question of how uncertainty is addressed as a consequence of time (the future) and incomplete information (prediction) due to a lack of knowledge (predictive theory). Experiments do not allow for time to resolve any remaining uncertainty, but decisions have to be taken in a once-and-for-all manner immediately.[7] Hence, in prospect theory, as the name indicates, time is the aspect that generates uncertainty, first as future time, but second by imposing an immediate decision point in the present, in which itself is not allowed to resolve any uncertainty. This arrangement has legitimacy for exploring the questions asked by Kahneman and Tversky,[8] but is by no means the only way of framing and stating the problem and possible solutions to uncertainty in decision making.

TIME AS A SOLUTION TO UNCERTAINTY

At the risk of stating the obvious, time is not only a problem in decision making but also opens up dynamic solutions to uncertainty. According to Simon's 'scissor metaphor', in judging the rationality of a decision, the decision process is one blade, and the structure of the environment is the other.[9] Hence, simple heuristics may be more

1. Simon, 1947
2. James, 1890
3. Kolb and Kolb, 2009
4. Ocasio, 1997
5. Kotler, 2022
6. Kahneman and Tversky, 1979
7. c.f. Eriksson, 2004
8. Kahneman and Tversky, 1979
9. Gigerenzer, 2010

functional and rational than ambitious analysis where the situation does not allow for it, for example, because of uncertainty. Consequently, it may be just as rational to make a decision based on scarce information or not to make more decisions than necessary for the moment and let time itself resolve remaining uncertainties, that is, to 'wait-and-see', rather than making any 'once-and-for-all' decision in a balancing act between prediction, control and acceptance of uncertainty.[10] As a solution to uncertainty, decision making is conceptualised as related to timing as a situation develops. Gigerenzer (2010) emphasised the environment's crucial role in decision making in what he called ecological rationality,[11] illustrated by the baseball player's challenge: the point is not to calculate correctly where the ball will touch the ground, but to be there just before it happens, which is achieved by keeping the angle constant by regulating one's own speed. Hence, time should essentially be understood in terms of timing decisions and actions in a dynamic and emergent environment.

DECISION MAKING AS A PROCESS

Decision making is an ongoing judgment about timing, essentially following emergent patterns in an environment. Therefore, managing uncertainty where there are too many unknowns, with occasional exceptions of acts of volition, evokes a process perspective on decisions. Decisions are not isolated but related in an ongoing process indistinguishable from perception as a flow of experience. More generally, this perspective is often associated with Whitehead's process philosophy and American pragmatism, which emphasises changing conditions and thus the need to learn in everyday situations; this has also inspired alternative streams of research in organisation theory.[12] A process view on decision making tends to emphasise its context and continuity to the point where decisions are not made, as much as they happen as a consequence of broader contexts and circumstances and for many different reasons. This has sometimes been emphasised to the point where bounded rationality has become understood as mere irrationality,[13] or used rhetorically to mock beliefs in rationality.[14] Ocasio (1997) argued that this interpretation is overly negative and disregards the organisational aspect of distributing selective attention through the assignment of different tasks and positions, making organisations capable of doing things individuals cannot do through specialisation and division of labour.[15]

MANAGING AS DESIGNING

While the above view of decision making as a process leaves little room for volition or active influence on circumstances, it can also be interpreted in more active ways, consistent with Simon's (1996) call for a design attitude for managers: 'Engineering, medicine, business, architecture, and painting are concerned not with the necessary but with the contingent – not how things are but how they might be – in short, with design'.[16] Simon argues that limited cognitive capacity leaves only a few aspects and alternative solutions to be considered in any situation, but the first step is always to create a representation of the problem, which typically has the solution hidden in it. While a decision attitude has a default idea of the problem, a design attitude starts by questioning how the problem is represented.[17] Hence, despite ambiguity about what aspects are essential and

10. c.f. Eriksson, 2004
11. Gigerenzer, 2010
12. c.f. Tsoukas and Chia, 2002
13. c.f. Ocasio, 1997; Gigerenzer, 2010
14. c.f. Brunsson, 2006
15. Ocasio, 1997
16. Simon, 1996, p. xii
17. Boland and Collopy, 2004

sufficiently attended to, there is a possibility to address this uncertainty and to (re)design both self through organising, decisions and action, and situations as well as aspects of the environment, without claiming predictive power or once-and-for-all permanent organisational 'stovepipe' solutions.

MANAGING AS ENACTMENT

Managing such co-emerging situations will have intellectual, practical and emotional aspects – how we think about uncertainty, how we respond to it, and how we feel about it.[18] As uncertainty or ambiguity will be omnipresent through differences in selective perception, sensemaking processes[19] will guide any understanding and response to situations. Furthermore, responses will influence how environments are enacted and how risk and timing of decisions are perceived.[20] Fostering a critical design attitude that questions assumptions will influence cognition and the perceived flow of experience, thus opening up alternative outcomes over time and increasing variation and exploration.

MANAGING SECOND-TRACK PROCESSES

Brehmer's theorising offers several options for further theorising in line with the research agenda for second-track processes suggested by Massingham (2019).[21] First, Brehmer's ongoing concern over decades was how to cope with dynamic situations of great complexity, which inspired an intellectual journey questioning many fundamental assumptions in management, both in civilian and military contexts. As Boland and Collopy (2004) suggest, the decision-making orientation of established theory has an attitude that hinders the search for new options and solutions instead of assuming the situation is a matter of choice between ready-made alternatives.[22] A design attitude instead seeks to challenge established assumptions, looking for new angles to tackle practical challenges in the real world. It is effective because it takes place in and interacts with the natural world, rather than seeking to implement abstract ideal types. To Brehmer, designing became the solution not only to decision making but also to the ontological matters of command and control (C2) and organisational structure, concluding that structural dimensions must be a matter of ongoing design work to match changes in a dynamic environment. Suppose the purpose and function of organising can be met by a fully distributed and flat form of organising. In that case, the design should be control without a commander,[23] as demonstrated by empirical evidence from experiments and ultimately tested by ongoing experimentation in real life.

In the following, Brehmer's work is presented, focusing on his most cited article on dynamic decision making and his last book, published only in Swedish the year before he died. After that, Brehmer's theorising is illustrated using two cases. Finally, Brehmer's contribution is discussed from the perspective of broader challenges of managing and coping with complexity and uncertainty.

BREHMER'S THEORISING

Berndt Brehmer (1940–2014) was a professor of psychology at Uppsala University, who established C2 science at the Swedish Defence University in 1997. He was a renowned academic and member of The Royal Swedish Academy of Letters, History and Antiquities and The Royal Swedish Academy of War Sciences. Brehmer's somewhat idiosyncratic theorising in decision making and organising, especially in crisis management and military C2, was recognised by the international community and received the Enduring Achievement Award at the International Command and Control and

18. Drehborg et al., 1994
19. Weick, 1995
20. Weick, 1995
21. Massingham, 2019
22. Boland and Collopy, 2004
23. Brehmer, 2009

Technology Symposium (ICCRTS) in Santa Monica in 2010. As an intellectual, he continuously revised and developed his thinking, and his last book was published in Swedish only in 2013, shortly before his death. While Brehmer published numerous articles in English, his theorising was never summarised for an international audience.

In contrast to the more one-sidedly negative theme of irrationality and decision biases, Brehmer's theorising developed through his most cited article on dynamic decision making in uncertain environments, exploring sensemaking via Boyd's OODA-loop (i.e., the cycle of 'Observe-Orient-Decide-Act'), which dominates military C2 thinking. He formulated C2 to design interaction within and concerning the organisation's environment. Hence, adaptation to dynamic and uncertain environments was at the heart of his theorising, interpreting organising and C2 both for the internal system and the external system, thus addressing the fundamental strategic question about adaptation to the environment. While formal hierarchical structure and authority are dominant in the military heritage, they also feature in civilian administrative theory, not least through Fayol. Brehmer instead defined C2 as a function, that is, what comes out of organising efforts, leaving it open for contextual conditions to decide what form it may take, hence: first 'purpose', then 'function' and last 'form'. This thinking paved the way for an award-winning paper with the provocative title 'Command without commanders', where several experiments in a computerised setting showed that firefighters were more efficient when working without any specific orders.

Both the attitude towards theory and the emphasis on testing theories, for example, through experiments, were guided by Brehmer's background in pragmatist traditions of thought and the insistence on the empirical testing of ideas.

However, these were approached without positivist claims of representing reality and validating the conceptual frameworks that generated the tested hypotheses. He was deeply sceptical of simplified, linear models of cognition of behaviourism. Brehmer's research into decision making and risk spans a broad field of subjects, from road traffic safety and control of industrial processes to military and crisis management. Furthermore, while his later theorising was strongly associated with military, civil/military or crisis management applications, Brehmer claimed his C2 theory to be generally applicable in different fields with sufficient complexity and uncertainty, including advanced medical care.[24] Below, Brehmer's theorising is presented through his most cited article and his last book, which appeared in Swedish in 2013.

DYNAMIC DECISION MAKING

In his most cited article, 'Dynamic decision making: Human control of complex systems',[25] Brehmer reviewed the research on decision making under conditions requiring a series of decisions that are not independent of each other, where changes in the environment occur both autonomously and as a consequence of the decision maker's actions, and where decisions are made in real time. He remarked that it was challenging to find normative theories for this situation and that research had mainly become descriptive. Consequently, he suggested a general approach based on control theory to organise research in the area, as well as an experimental paradigm of computer-simulated microworlds for the study of dynamic decision making. However, 'Humans make decisions in increasingly complex, highly uncertain, and dynamic environments that evolve over time in intricate ways... Surprisingly, the area of behavioural decision research has little to offer in terms of theoretical principles and practical guidelines on how people make decisions in dynamic situations'.[26]

24. see Lagerstedt, 2016
25. Brehmer, 1992
26. Gonzalez, 2022, p. 15

The experimental approach suggested by Brehmer (1992)[27] aimed at assessing the effects of system characteristics on decision makers' behaviour in dynamic tasks. This required a taxonomy of tasks according to aspects affecting performance as the first step towards further theorisation, namely: complexity, feedback quality, feedback delays, the rate of change, the relation between the characteristics to be controlled and those of the process used for control, and finally, the extent to which the decision-making power in the system can be delegated or distributed among persons in the system. One of the general findings from these early experiments was that decision makers are poor at handling systems with long feedback delays.[28] Brehmer (1992) commented that feedback delays are inevitable in most complex systems and that the ability to cope with such delays is a central feature of handling complex dynamic systems.[29] He furthermore concluded that since feedback delays and side effects are common aspects of real-world systems, decision makers dealing with complex dynamic systems should be expected to show a suboptimal level of performance.

COMMAND AND CONTROL AS A DESIGN SCIENCE

Brehmer's last book, *Insatsledning*, discussed and clarified the C2 science he had established at the Swedish Defence University. It summarised his research effort and revealed that he believed he had more work to do: 'The purpose of this book is to introduce command and control science as it developed during its first fifteen years at the Swedish Defence University. The book should be seen as a status report, a description of how far the work to establish the subject has come and not as a final report. Much remains to be done.'[30] He immediately clarified that the intention was not to describe C2 as it was performed in Sweden or any specific country but to describe the character of C2 science, its fundamental problems, current solutions and at what price they come. In other words, nothing less than to lay the theoretical foundation for science about and for C2.

C2 science, like many other disciplines, has emerged with a practical intent – in this case, to support the development of new C2 systems that are possible through the progress made in information technology. This also puts C2 science in the realm of the design sciences.[31] Unlike natural or social science, the purpose of which is to study what already exists, design sciences aim at what does not yet exist. The practical context is the ambition to tear down traditional hierarchical 'stovepipe' organisations in the pursuit of 'network centric warfare', not least through the US Department of Defence's Command and Control Research Program 1994–2011, which also had its counterpart in Sweden and other countries. As a research discipline, C2 science should follow pragmatist criteria for scientific endeavours, namely, to achieve its goals via a design solution, with generalisability through the formulation of more general design suggestions, expressed in terms of their functions to be adapted in local applications. Hence, the purpose of C2 science is to formulate general design rules and describe how these can be adapted to specific conditions.

From a design perspective, C2 is nothing but a response to the requirements of the environment. Contrary to the civilian use of the term 'command-and-control' mainly as shorthand for 'bad hierarchical management', the term C2 in this context does not say anything about what form it takes – it may or may not be hierarchical and should always be functional.

27. Brehmer, 1992
28. Gonzalez, 2022
29. Brehmer, 1992
30. Brehmer, 2019, p. 9, author's translation
31. c.f. Simon, 1996; Boland and Collopy, 2004

The construction of an artefact (such as C2) has five levels, which designate the knowledge needed to perform the design work. The upper level concerns the purpose of the artefact, that is, why it should exist and what should be achieved by constructing it – in the case of C2 building systems that contribute to direction and coordination of efforts. On the next level, the design criteria should characterise how the artefact fulfils its purpose. These are founded on the demands of the external system. The environment presents to the artefact – in the case of C2 agility, whether it can cope with complexity and handle frictions and delays. The third level is the function, which describes what the artefact should do to fulfil the purpose. Functions stem from a theoretical analysis of what is needed to achieve the artefact's purpose. The analysis results are then tested in the design to explore whether a satisfactory artefact can be constructed given the functions specified by theory or by using theory to explain existing artefacts – in the case of C2, the functions are effects, data collection, orientation and planning. The fourth level of general processes represents the general scientific knowledge from which ideas can be retrieved concerning how the functions could be realised in form. Finally, the fifth level – form – represents the final artefact – in our case, the C2 system.

Brehmer insisted that C2 science does not promote any specific design or form per se. Instead, it is driven by the need to find new and better ways of organising, new methods, and roles or support systems that contribute to the C2 systems' ability to cope with complexity, handle frictions and delays and create greater agility than before. As the environment is constantly changing, with the development of new technology, new tactics, and new communication systems, as well as new forms of conflicts, disasters or accidents, the study of the external system, the environment and its requirements for C2 will never end. Identifying new requirements that the C2 system should meet or defining the design criteria is an ongoing challenge so the questions will reoccur:

- Why? (purpose)
- In which way? (design criteria)
- What? (function)
- What can be used? (general processes)
- How? (form)

There is no single scientific discipline that can answer all these questions. Instead, answers and suggestions may be found in engineering, behavioural sciences and social sciences alike. Another source of inspiration may be other artefacts constructed for purposes other than C2. Network-centric warfare, as well as social media, may be such examples.

COMPLEX UNDERTAKINGS

On the international C2 stage, Brehmer stood out for his somewhat idiosyncratic way of theorising, not least about complex undertakings, such as civil-military collaboration and similar situations of multi-agency collaboration where no traditional hierarchical management solution was applicable for reasons of legality and legitimacy. In the face of crisis, legal arrangements for formal collaboration may not be in place. For many civil organisations, such as the Red Cross, it could be devastating for their reputation and trustworthiness to subordinate themselves under other organisations' commands. Much of the theorising around the ambitions of network-centric warfare focused on how different military branches should be able to collaborate across hierarchical borders in stovepipe-like organisations, hence developing classifications of different levels of collaboration.

Brehmer's design methodology led to a different way of thinking, starting with the requirements of the environment and first then asking questions about what *form* could best meet those. Consequently, his award-winning paper 'Command without commanders'[32] may have appeared

32. Brehmer, 2009

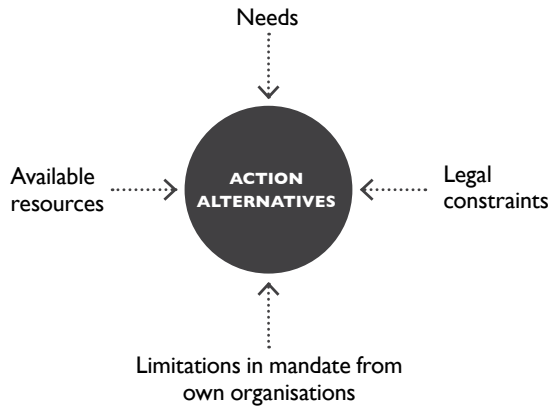
counter-intuitive if not shocking to a military audience to which hierarchical organising is mostly an axiomatic belief. Brehmer's experiments, however, showed repeatedly that firefighters without commanders were more efficient in their tasks than those having to follow the commands of a superior.

Complex endeavours involve collaboration between different organisations or parts thereof, typical in national emergencies, international disaster relief efforts or a comprehensive approach to civil-military collaboration. According to Brehmer, such situations differ from ordinary direction and coordination within one organisation in five ways.

1. A complex endeavour has several foci (or centres of gravity in military terms), and the criteria for success involves that every part should be able to bring their service.
2. Complex endeavours focus on a totality rather than one.
3. A complex endeavour often starts with several parallel efforts and the need for coordination and possibly a common direction appears as the situation evolves.
4. The focus of coordination is on independent organisations rather than on individuals.
5. There is no unity of command across different organisations and no simple hierarchical order as an organising principle.

In such situations, collaboration is the only possible way to achieve coordination and direction. In line with the design logic presented above, collaboration is seen as the *function* that achieves coordination and possibly direction. The question of *how* collaboration is achieved is specific to each situation since it all depends on the actors involved and what legal and other circumstances define it. At any rate, the design methodology remains the same: to achieve direction and coordination (purpose) within the limits of legal frameworks, negotiation mandates, possible influence on the complex endeavour (design criteria), effect, data collection and orientation (function). Of crucial importance is the ability to create and make choices within what Brehmer, inspired by Rasmussen (1997),[33] called the possibility space, that is, the degrees of freedom to be resolved according to subjective preferences. The possibility space is constructed through the information available, and the choices filling this space should represent alternatives available for the collaboration partners. Figure 1 shows what such a possibility space may look like:

FIGURE 1. THE POSSIBILITY OF SPACE IN COLLABORATION BETWEEN ORGANISATIONS[34]



As the possibility space in Figure 1 is the result of considering all limitations, it will consist only of available action alternatives. Given the circumstances, the possibility is that space may as well be wholly empty or non-existing, for example, if some of the restraints make it impossible to generate any alternatives. In such cases, there is nothing to agree on. When action alternatives are available, they need to be complemented with value functions for making a choice between them, which is a matter of negotiation between collaboration partners. In complex endeavours, the planning function does not typically exist in

33. Rasmussen, 1997
34. Adapted from Brehmer, 2013, p. 147

the coalition's design hierarchy but within the respective organisations themselves. However, such a joint planning function may develop over time. A related notion is one of harmonisation of efforts, where collaboration is made in the spirit of cooperation, by the method of negotiation and in substance, means the management of interfaces.

Despite the challenges to the internal system in complex endeavours, the fundamental challenge to match the external system remains the same. Therefore, the notion of possibility space remains crucial. In the case of antagonistic threats, such as in military applications, the possibility of space is limited by seven factors:

1. the task given;
2. own resources;
3. available time;
4. terrain;
5. rules of engagement;
6. adversaries' possibility of space;
7. doctrine, which also includes training.

The possibility of space exists only for a given time – after only a short while, the situation may have changed. Consequently, it is crucial to know that time influences the possibility of space and how much time is available. To discover action alternatives within the limitations of any situation is a matter of creativity. Unfortunately, an adversary will have a corresponding possibility space and creativity to extend it according to their skills and initiative. Hence, in real-world situations, the awareness and management of the possibility space are decisive for developing the situation.

In non-antagonistic disaster relief situations or applications in other domains, time may still be crucial as situations develop, influencing the possibility of the development of space. Wise and timely management of the possibility space may extend it and the range of action alternatives for all collaboration partners. The management of the possible development is described as a case of dynamic decision making or with an emphasis on the generation of new alternatives – an illustration of managing as designing.[35]

DYNAMIC DECISION MAKING – TWO CONTEMPORARY CASES OF CRISIS MANAGEMENT

When Professor Berndt Brehmer pioneered the research field that was grounded on the application of system dynamics and system thinking to military command and control, it was with an intent to gain an understanding of why and how managerial and strategic decision making seemed to be associated with significant difficulty among the practitioners of crisis management. These were typically 'first responders', such as firefighters, police officers, paramedics and military commanders. He found that dynamic decision making (DDM) research could provide important insights into these difficulties and highlight possible remedies. Not surprisingly, these remedies were closely tied to how training and exercises among first responders were conducted. As mentioned earlier in this paper, decision making at a strategic level of command is no different from lower levels, operational and tactical, when handling the dynamic complexity of typical crises.

The primary theoretical basis for DDM is common ground concerns about interdependent decision making. This takes place in an environment that changes over time, either due to the previous actions of the decision maker or due to events that are outside of the decision maker's control. Typical for emergency response and crisis management, decisions need to be made in real time: the decision maker has to consider the dimension of time explicitly. It is not enough to know what should be done, but also when it should be done, to achieve optimal results. As an analytic tool

35. c.f. Boland and Collopy, 2004

ideal for DDM, system dynamics provides the language that visually demonstrates how seemingly simple model structures could result in highly complex (even chaotic) behavioural processes when subjected to mathematical/numerical simulation in a computer program.

Brehmer argued that a crisis and crisis management process undergo two critical points during its timespan.[36] The first is, of course, the outbreak or 'trigger event'. At this point, it is critical to detect and interpret correctly the weak signal[37] that is usually associated with the outbreak. If the crisis is not successfully handled at this early stage, usually by some first-response measures, the next critical point will be at the intersection of resources needed and resources available (Figure 2). This is where the demands of the crisis management situation (for example, a fire spreading) overshoot the resources (for example, firefighting units) we have at our disposal to 'combat' the crisis.

Beyond this intersection, which we might call the 'tipping point', it is no longer possible to attack the crisis using direct approaches. Instead, one needs to apply resources under indirect control and indirectly attack the source of the crisis. For example, with a forest fire, a direct approach would be for the firefighters to use water hoses to spray water directly at the base of the fire. An indirect approach would be to clear the area's flammable material before the fire spreads to that area.[39] Conversely, the additional resources needed may not be under direct control. Instead, the fire chief may have to call on off-duty reserves and perhaps voluntary firefighters from nearby stations.

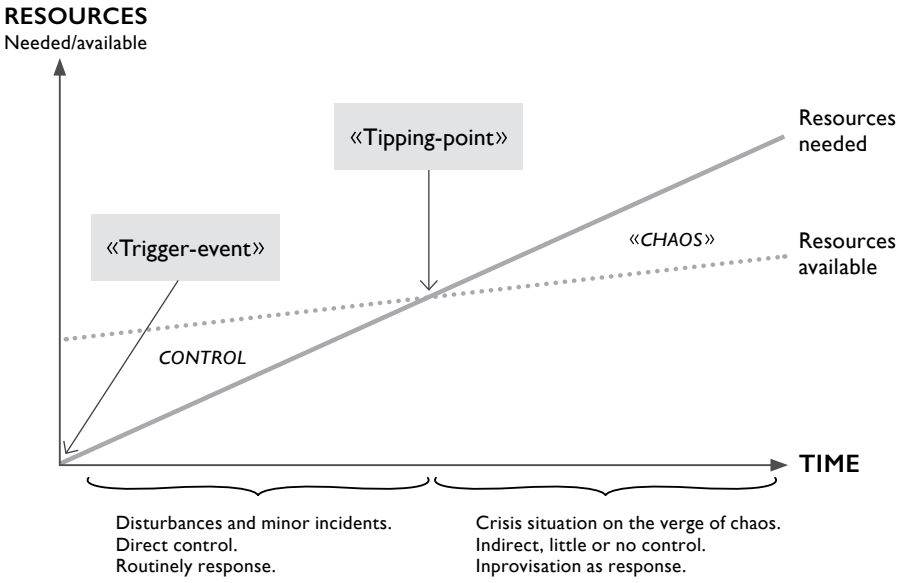


FIGURE 2[38]

36. Brehmer, 2002
37. Ansoff, 1975
38. Adapted from an original Bakken and Hærem (2020) (Norwegian language) publication; this version adapted from Brehmer (2000)
39. Brehmer, 2002

These resources may take longer to deploy because of extended travel and preparation time. It is also uncertain whether these additional resources are available or occupied elsewhere.

It is unarguable that when crisis management is situated in the region to the left of the tipping point, it has the character of day-to-day routine, following procedures familiar to most first responder units – with few or no surprises to the decision maker. The structure of a 'left-side' decision-making process may follow the OODA loop, which emphasises quick, routine decision making in a domain where familiarity, experience and expertise will be helpful if not necessary. In a typical combat situation, making the optimal decision is usually associated with thinking and acting faster than the enemy. In addition, Gary Klein's (1997) RPDM model[40] (recognition-primed cognition) will be of relevance here – the decision making is triggered by almost instant recognition (from previous experience) and allows quick and decisive handling of the crisis.

To the right of the tipping point, however, the relevance of routine, experience and established procedures may fall short, and instead, improvisation may be vital for handling the crisis. When the decision maker discovers (eventually) that their experience is not valid in the situation, the process of sensemaking[41] becomes vital. In particular, proactive sensemaking is crucial for crisis management in which a quick response is of the essence when there is significant uncertainty and there is much value at stake. Being proactive in a crisis requires that the proper mental models, encompassing the dynamic complexity of the situation, are in place beforehand (usually a product of massive training and exercises). This is because the great paradox in crisis occurs when the situation is most urgent (and intensifying), and the critical resources needed are farthest away (and diminishing).

Hence, decision making on the verge of chaos entails agility of command. While static top-down hierarchical command organisations may do the job to the left of the tipping point, moving beyond the intersection requires a dynamic or agile organisation where the command authority is pushed downward in the ranks, opening up for mission command or command by intent. This also emphasises the potentially crucial role of the 'strategic corporal' and command without commanders, as already noted. The problem with this dynamism is that it is seldom, if ever, exercised at a larger scale and, therefore, mainly unknown to the personnel. Hence the strategic surprise element of crisis management.

The crucial point is that a decision maker should be trained in strategic decision making and sensemaking to have acquired complex mental models (of non-linear delayed feedback) to be successfully proactive.[42] The idea is to 'foresee' the tipping point and engage in processes that involve indirect control regarding the supply of resources and how the resources are applied. In this crisis management phase, improvisation may be necessary, as the alternative is the total loss of control and chaos.

We argue that the most common source of a surprise in crisis management comes from not having undergone broad and deep crisis management training, which also triggers elements of indirect control.[43] The indirect courses of action (right side of the tipping point in Figure 2) are by nature less frequently encountered in real-life crisis management and, therefore, in greater need of training and exercises to be successful, compared to more routine, everyday situations. This kind of training is more challenging and resource-intensive because both types of strategies (direct and indirect) may be applied

40. Klein, 1997
41. Weick, 1995
42. see Gonzalez et al., 2017
43. see Brehmer and Dörner, 1993; Bakken and Gilljam, 2003a, 2003b

simultaneously. However, indirect strategies tend to be more costly financially and inconvenient to the public than direct strategies. In addition, they may take longer to apply (and therefore yield more significant losses) if not prepared in advance.

To illustrate a crisis that entails direct and indirect strategies, we can take the ongoing energy crisis as an example from the recent COVID-19 pandemic.[44] The Russo-Ukrainian war has allegedly triggered the energy crisis, in which Russia's strategy has been to cut off much of the energy supply to Europe. This is combined with sanctions from the EU countries to ban much of the Russian energy supply to Europe. This has led to a price surge, making it extraordinarily costly for households to keep up their energy consumption for heating and cooking and a price increase in other sectors as industry and public services are also faced with steeply increasing prices.

The dynamics can be analysed as follows: in a normal situation, there is an instantaneous balancing between the supply and demand of energy through the pricing mechanism in the market. Energy is produced in a process where the marginal production cost over time equals the average production cost. Prices may fluctuate in the short run but do not dramatically deviate from the long-term average, and not for a longer time.

Now for the crisis: a pivotal point occurs when the influx of 'raw materials' (water, gas, oil) is no longer enough to replenish the volume used in production, and the projection indicates that this situation may endure. This pivotal change takes us to the tipping point, where marginal production costs rise dramatically and possibly in an exponential growth fashion. Since consumers of energy (in the short run) have few alternatives to electricity or gas, prices to consumers also skyrocket (prices to be inelastic).

The industry and public services also face these higher prices, which feed into the process of consumer goods, leading to inflation and higher interest rates. The problem is aggravated by energy production companies wanting to harvest the high prices and sell out whatever energy is left in the reservoirs or storages at the highest possible prices. This positive feedback loop will inevitably lead to an accelerating drain of energy reserves until power has to be cut off and consumers and industry have used reasonable alternatives to electricity or gas. The remedies are, of course, to apply indirect control strategies, as illustrated in Table 1 below.

TABLE 1: DIRECT AND INDIRECT CONTROL DURING THE ENERGY CRISIS

ENERGY CRISIS – ELECTRICITY (national perspective, waterfall source)		**RESOURCE AVAILABILITY AND SUPPLY (type of control)**	
		Direct	**Indirect**
Resource application (type of control)	**Direct**	Supply and demand are balanced through a pricing mechanism.	Overseas/cross-border cables for international exchange of excess electricity.
	Indirect	Alternatives to receiving electricity from the national and regional power grid: solar power, wind power, sea turbines, heat pumps, energy conservation.	Alternative, renewable energy sources are also connected to an international grid for exchange. Nuclear power. Cold fusion (future?)

44. see Bakken and Hærem, 2020

Table 2 below shows examples of combinations of direct and indirect strategies applied analogously to a military campaign depending on whether the resources are under direct or indirect control.

TABLE 2

MILITARY CAMPAIGN EFFECTS-BASED APPROACH		RESOURCE AVAILABILITY AND SUPPLY (type of control)	
		Direct	**Indirect**
Resource application (type of control)	**Direct**	Tactical level combat (attrition principle).	Total defence concept; military and civilian collaboration.
	Intermediate	Operational-level warfare (manoeuvre principle).	Joint operations with support from coalition forces.
	Indirect	Network centric warfare (NCW), including Specops, Psyops, Humint, Time sensitive targeting (TST), Hybrid threats, and Long-range missile strikes.	Joint operations with integrated coalition forces. Trans-national measures (DIME), including economic sanctions, diplomacy, negotiations, and information (propaganda).

These examples illustrate the profound challenges that may face organisations in times of crisis, especially when the possibility space has not been correctly estimated or insights of tipping-point character have been missing in doctrine, including training. Gonzalez et al. (2017) referred to results from laboratory experiments using complex DDM tasks as well as cognitive models, arguing for training recommendations that:[45]

1. allow individuals to learn at a slow pace to help them adapt successfully to more significant time constraints;
2. train individuals with a diverse set of experiences to increase the possibilities of effective adaptation to novel situations; and
3. use reflection over an expert's performance during training to reinforce instances of high quality instead of a reflection of self-performance of outcome feedback, among others.

To deal with dynamism and uncertainty, timing in managing or designing the development possibility space is crucial. This, in turn, is a matter of training allowing for such expansion of possibilities through negotiations within collaborative constellations and with the environment.

DISCUSSIONS

The purpose of this article was to present Brehmer's take on dynamic decision making under uncertainty and discuss its broader implications. Essentially, it was an intellectual journey of fascination with the complexities of human logic and its possibilities despite cognitive shortcomings. Brehmer's theorising stood out internationally both in its form, starting in pragmatism in a time where it was just about forgotten and ending in managing as designing, and in its content, delivering counter-intuitive results, challenging taken-for-granted assumptions through award-winning experiments.

45. Gonzalez et al., 2017

All this without losing focus on practicality and reason for the sake of esoteric speculation. Instead, Brehmer's work took on the most challenging novelties driven by technological developments within information technology at a time where it challenged century-old traditions of organising in one of the oldest professions, the military, which has been the role model for hierarchical, structure-oriented ways of organising both industry and administration. The contribution was at once practical and profound and has been characterised as 'directed basic research'.[46]

This journey culminated in exploring situations where hierarchical order and unity-of-command cannot exist or are ineffective, such as in complex collaboration between organisations that by law or legitimacy must be independent or where experimental evidence demonstrated the efficiency of distributed solutions and command without commanders. In this way, Brehmer's work took on the most complex challenge of learning: to unlearn earlier knowledge, often in the form of taken-for-granted assumptions.[47] A design attitude showed to be an appropriate tool for this task of questioning assumptions for the sake of practicality and usefulness of new solutions in pragmatist defiance of tradition, instead making room for human imagination and experimentation. This intellectual play brought about a notion of C2 and managing as designing possibility spaces by boundedly rational humans, yet capable of introspection, meta-cognition, self-reflection and experimentation in the face of uncertainty and threat, as opposed to behaviourist views of humans as cognitively limited, if not faulty, decision automata.

Brehmer's theorising took on many of the challenges nowadays known as second-track processes, not least concerning complexity, cognition, uncertainty and organising, especially regarding the logic of negotiation in complex endeavours. Nevertheless, Brehmer's work also links recent attention to second-track processes to long-standing debates in technology, social sciences and philosophy of science. While Kahneman and Tversky made behavioural economics famous, their take on uncertainty in decision making was not self-evident, and their framing was not innocent in that it excluded the perhaps most common way of handling uncertainties. Namely, use the time to resolve uncertainty in dynamic situations rather than static once-and-for-all decision making. This addresses the roots of thinking about uncertainties and learning the earliest works of American pragmatism towards the end of the 19th century. Already the insights about the selectivity of attention imply ambiguity and, thereby, uncertainty. Time as a solution is the fundamental aspect opening up for dynamic decision making as an ongoing judgment of timing. In extension, a design attitude focuses on the generation of alternatives expanding the possibility space, rather than merely choosing among existing alternatives of action.

As much as this may sound like a recipe for managing second-track processes, it is also a recipe for managing through enactment in direct interaction with the world, albeit a less than objective one understood through the necessity-biased perception of boundedly rational actors.

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46. Johansson and Sahlin, 2015
47. Hedberg, 1981

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ARTICLE

HOW CYBERNETICS EXPLAINS BEHAVIOURAL TENSEGRITY AND ITS ADVANTAGES FOR SOCIETY

Dr Shann Turnbull

Our regular contributor Dr Shann Turnbull builds on the engineering principle of tensegrity, in which conflicting behaviour of different materials introduce systemic self-correction to disturbances. Distributed decision-making, described as polycentric governance, is required to systemically generate conflicting checks and balances.

INTRODUCTION

The cybernetic 'law of requisite variety'[1] explains why natural systems, biota and self-governing social organisations possess paradoxical opposing but complementary, dual behaviours described as 'tensegrity'.[2] These dual opposing but interdependent, Yin~Yang-like behaviours create various checks and balances required for self-regulation and self-governance.[3] Crucially, tensegrity drives evolution by continuously generating organisational adaptions required to survive ever-changing and so unknown environmental conditions.[4]

This article explains how the contrary behaviour of tensegrity undermines the most influential theories of firms and agency theory. Also explained is how in modern societies, tensegrity in individuals is inhibited, denied and punished in the centralised command and control hierarchies that dominate the public, private and nonprofit sectors. This may explain why tensegrity and its advantages for firms and global governance have been overlooked.

Even Ostrom,[5] who identified design principles for self-governance in her Nobel Prize acceptance

1. Ashby, 1956, p. 206
2. Turnbull and Guthrie, 2019, p. 54
3. Ingber et al., 2014
4. Ingber, 2000, 2008
5. Ostrom, 2009, p. 422

speech, did not identify the need for opposing behaviour. This is because opposing behaviour already existed in her case studies involving competition for control of common pool resources (CPRs) that could otherwise create a 'tragedy of the commons'.[6]

Ostrom's[7] case studies were mainly concerned with unincorporated CPRs like hunting, gathering, fishing and water resources. Property rights were considered by Ostrom but in a way that allowed them to be ignored in her design principles. Nevertheless, property rights cannot be ignored with incorporated CPRs. The endowments of citizens with CPR property rights to create locally owned and controlled bioregional self-governing eternal circular economies are crucial in reformatting Ostrom design principles.[8]

Business corporations introduce competitive claims to corporate resources not just between shareholders and other stakeholders but between different stakeholder constituencies. For example, suppliers of goods and services have incentives to increase prices, while customers possess opposing incentives to seek reduced prices.

Suppose corporate resources are to become a CPR providing benefits for all stakeholders, as proposed by the US Business Round Table. In that case, each stakeholder constituency needs to establish its own independently elected representative bodies to introduce what Ostrom describes as 'polycentric' governance.

Polycentric governance introduces tensegrity from the *tensions* between different stakeholder interests, together with the *integrity* of divided power to negotiate win-win solutions to distribute benefits to all stakeholders. This is consistent with Fuller[9] coining the word 'tensegrity' by combining the words 'tension' and 'integrity'.

Despite its potential, the phenomenon of tensegrity has been overlooked by social scientists. The author pioneered its introduction to social analysis in his PhD dissertation when he initially described it as 'social tensegrity'.[10]

Social scientists may have neglected tensegrity because they have: (a) described the phenomenon with different words like 'paradox'[11] which is considered dysfunctional and something neither positive nor systemic; (b) discounted the ancient Yin~Yang terminology as being irrelevant to modern society and organisations, not recognising that the phenomena is hard-wired into all humans and other biota;[12] (c) focused their research on publicly traded firms that inhibit, deny and punish contrary individual behaviour for denying tensegrity emerging and being identified;[13] (d) not appreciated that tensegrity facilitates behavioural adaptation in individuals and organisations; (e) not recognised that tensegrity is the driver of evolution throughout the universe[14] to suggest social organisations could also adopt it.

Biota cannot survive without the ability to become self-governing and reproduce in unknown dynamic complex environments. Understanding how tensegrity continuously generates and reproduces comprehensive adaptations is vital for understanding the processes of creating sustainable physical, biological or social wellbeing. This understanding is required to ensure that the concept of tensegrity is embedded into any local and global system of governance.

6. Hardin, 1968
7. Ibid.
8. Turnbull, 2022a, p. 97
9. Fuller, 1961
10. Turnbull, 2000b, pp. 8, 69, 84, 134, 135, Turnbull, 2014b, pp. 11, 85, 103, 172, 173, 174, 179
11. Smith and Lewis, 2011
12. Ingber et al., 2014
13. Turnbull, and Poelina, 2022, p. 16
14. Suggested by Bohm, 1980; Ingber, 1998, p. 39

This article also explains how centralised command and control hierarchies that dominate modern society inhibit, deny and punish contrary behaviour. This has denied insights into how to introduce self-governance to avoid tragedies of the commons without 'markets or State'.[15] Self-governance requires decentralisation of power to allow bottom-up and outside-in decision-making influences, as well as top-down guidance. Tensegrity is a defining feature of a polycentric type of governance that creates a 'holonic' architecture described by Turnbull and Guthrie.[16] It allows complex global problems to become locally simplified with various supplementary controllers to 'amplify regulation'.[17]

The following section outlines the significance of introducing tensegrity to organisational analysis and how its emergence in firms is dependent on them possessing distributed decision-making. I then explain how tensegrity is denied in economic and financial analysis. Systemic operating problems arising in hierarchical organisations are discussed in the following section. Alternatives to hierarchies and the knowledge gap in teaching self-governance are then reviewed, followed by a 'call to action' in promoting the transformation of the theory and practice of corporations for the benefits for all stakeholders. Concluding remarks raise the need to educate governance architects and research the role of tensegrity in the universe.

THE SIGNIFICANCE OF TENSEGRITY IN A SOCIAL CONTEXT

The need to understand the concept of tensegrity arises because it explains how to design and establish self-governing organisations that can reduce the role, size and cost of government, as well as reliance on markets that have failed. Lord Stern advised the UK government in 2006 that climate change was created by the 'the biggest market failure the world has ever seen'.[18] This failure continues, aggravating existential risks to humanity as neither Stern nor anyone else has proposed stopping market failure except your author.[19]

Another threat to humanity that makes self-governance and, therefore, tensegrity arises from the need to counter the degradation of the atmosphere, oceans, sources of fresh water, soils and biodiversity locally. These problems create another reason for introducing local self-governing bioregional organisations to engage locally with citizens to take corrective action on a collective self-determined democratic basis. No such facility exists on either a global or national basis. A crucial need for such local democratic institutions is to manage the population density in each bioregion in a way that is consistent with establishing eternal circular economies.[20]

Humanity is exposed at the global level, what has been described at the local level as 'the tragedy of the commons'.[21] Ostrom[22] identified how this tragedy could be avoided with 'polycentric self-governance'. Introducing tensegrity would provide a basis to convert polycentric governance into an ecological form of governance ubiquitously found in nature. Ostrom identified how polycentric self-governance required neither markets nor states, which is consistent with them not being used by nature. Two features found in biota but not included in Ostrom's design principles were limits on size and age.

Biologist Ingber[23] described tensegrity as 'the architecture of life'. He explained how 'tensegrity structures offer a maximum strength for a given

15. Ostrom 2009, Turnbull, 1994
16. Turnbull, and Guthrie, 2019
17. Ashby, 1956, p. 265
18. Stern, 2007, p. xviii
19. Turnbull, 2022b
20. Turnbull, 2021b
21. Hardin, 1968
22. Ostrom, 2009
23. Ingber, 1998, p. 30

amount of building material'. One way of explaining the success of polycentric governance in social organisations is that it allows the engagement of the maximum number of individuals while minimising data overload of the individuals involved in decision-making, control and communications. Here it is consistent with Weiner's[24] concept of cybernetics as the science 'of control and communication in the animal and the machine'.

The application of tensegrity from physical and biological structures to social relationships

The application of tensegrity from physical and biological structures to social relationships was achieved by using bytes as the unit of analysis.[25] Shannon[26] and Ashby,[27] who founded the science of cybernetics, referred to 'bits' as their unit of analysis. Eight bits is described as a 'byte', a term used to define the storage and processing capacity of electronic devices. For this reason, the word byte is preferred to the word 'bit' that has an alternative connotation.

At the end of the last century, research scientists[28] at the British Telcom organisation identified humans' physiological limits to receiving or transmitting bytes. Other scientists[29] identified the ability of our brains and nervous systems to process and store bytes. These limits provide governance architects with fundamental criteria for designing reliable and resilient organisations using elementary cybernetics' insights.

In applying the law of requisite variety, Ashby[30] pointed out that 'The gene pattern, as a store of channel of variety, has limited capacity. Survival goes especially to those species use the capacity efficiently'.[31] This indicates the need for living things to minimise the materials and energy required to transact bytes/data for living things to be created, survive birth, thrive and reproduce in an unknowable dynamic complex environment.

The ability of gene patterns to guide behaviour can arise from direct programming and the more efficient amplification process. Ashby explains how 'amplifying regulation'[32] is only possible indirectly through supplementary sources of variety provided by the environment.[33] The dual paradoxical nature of tensegrity generates the requisite variety required for 'regulating the very large system'.[34] This leads to our first hypothesis.

> *Hypothesis 1*. **Tensegrity creates a requisite variety of instinctive and learned behaviours for living things to survive their creation and reproduce in dynamic unknowable complex environments while minimising the material and energy required in their DNA.**

The human brain vividly illustrates the physical demands of data processing. While the weight of matter in the brain is less than 2% of the total body weight, the amount of energy is ten times greater, 20% of the total used by the body even at rest.[35] The energy used by different brain parts varies according to how vital the data channel is for survival.[36]

24. Wiener, 1948
25. Turnbull, 2000, p. 1, Turnbull 2014b, p. 1
26. Shannon, 1948, p.1
27. Ashby, 1956, from p. 126 onwards
28. Cochrane, 2000
29. Kurzweil, 1999
30. Ashby, 1956, p. 270
31. Ibid., p. 244
32. Ibid p. 265
33. Ibid.
34. Ibid., p. 244
35. https://hypertextbook.com/facts/2001/JacquelineLing.shtml
36. https://www.brainfacts.org/brain-anatomy-and-function/anatomy/2019/how-much-energy-does-the-brain-use-020119

Tensegrity in organisations arises from distributed decision making

The architecture of our brains' communication and control channels also illustrates distributed decision-making that is representative of polycentric governance. According to neurologist Kelso,[37] different brain areas become responsible for making decisions. Kurzweil[38] reports that: 'There is no Chief Executive Officer neuron'. Different parts of the brain compete with others for dominance according to internal needs and drives and external risks and opportunities for survival. Such distributed (polycentric) decision-making provides a way to decompose decision-making to reduce the data processing material and energy required at any location while also allowing parallel decision-making.

An illustration of how organisational decision-making can be decomposed and so simplified is provided in Figure 1. It shows how the eleven identified activities of directors of an 'Anglo' unitary board, marked with an X, are distributed to five differently constituted 'Control centers' of a 'Mondragón compound board'.

FIGURE 1: MONDRAGÓN COMPOUND BOARD COMPARED WITH UNITARY BOARD[39]

BOARD TYPE →	MONDRAGÓN COMPOUND BOARD					ANGLO
Control centres[a]	**Watchdog Council**	**Supervisory Board**	**Management Board**	**Social Council**	**Many Work Units of:**	**Unitary Board**
Members	3	5-8	4-6	~5-25	~10-20	~4-12
Function[b]	Governance processes	Appoint Management Board	Organise operations	Worker welfare	Production, Elect Social Council	Manage
Activities	Efficacy and integrity of processes	Integrate strategic stakeholders	Efficient allocation of resources	Establish working conditions	Job organisation and evaluation	Direct and control
Internal[b]	X		X	X	X	XXXX
External[b]	X	X				XX
Short term[b]	X		X		X	XXX
Long term[b]		X		X		XX

Degree of decomposition of information processing labour indicated by allocations of 'X'

a Omits the General Assembly, which elects Watchdog Council and Supervisory board;

b Descriptions follows typology of R. I. Tricker, Corporate Governance: Principles, Policies and Practices

37. Kelso et al., 2013
38. Kurzweil, 1999, p. 84
39. Turnbull and Guthrie 2019, p. 67

The separation of powers introducing checks and balances in decision-making is similar to the way our brains are designed to exhibit the contrary~complementary behaviour of tensegrity. Behaviour that may be inhibited or dysfunctional from 'group think' can emerge in an organisation with a single board.

TENSEGRITY IS DENIED IN ECONOMIC AND FINANCIAL ANALYSIS

Three years before Jensen and Meckling[40] published their agency theory of the firm, Wearing, a professor of psychology, identified in 1973 how the model of human behaviour used by economists and finance scholars was inconsistent with reality as set out in his Table 1: Differences between 'Economic People' and 'Real People'.[41]

TABLE 1: DIFFERENCES BETWEEN 'ECONOMIC PEOPLE' AND 'REAL PEOPLE' (WEARING 1973)

	ECONOMIC PEOPLE	REAL PEOPLE
1	Unlimited appetite	Appetite determined and limited by the necessity of maintaining the organism in a state of dynamic equilibrium.
2	Completely informed	Reduces, condenses, summarises (and thus necessarily loses) information. In addition, an 'imperfect' communications network in the environment also restricts and attenuates the flow of information.
3	Consistently orders his/her preferences between outcomes over time	Does not consistently order his/her preferences (i.e., changes his/her mind over time, may prefer A to B, B to C but C to A).
4	Maximises something (usually one thing)	Attempts to optimise concerning many criteria (needs).
5	Competitive	Sometimes competitive, sometimes collaborative, and usually both.
6	Requires a value system only in order to provide a criterion against which to maximise (e.g., profit, utility, prestige and power)	Requires a value system to provide a framework for the ordering of needs, the selection of information and the weighing of multiple decision criteria.
7	Not explicitly related to the world as an element in interactive system and remains unchanged, as a result of any interaction	Stands in an interactive cybernetic relationship to his/her community and environment and is changed, as a result, of any interaction.
8	No significant differences between individuals	Differences between individuals are significant and important.
9	No limits on information processing capacity, so is unaffected by differences in rates of change	Limited information processing capacity so prefers slow rates of change, (i.e., nearly stable systems).
10	Needs are simple and few	Needs are simple and many.

40. Jensen and Meckling, 1976
41. Wearing, 1973

As discussed below, agency theory was based on a model of human behaviour that does not match reality. Perhaps, to respond to critiques of agency theory over the following 18 years, Jensen and Meckling published in 1994 'The Nature of Man'. They concluded 'that the explanatory power of REMM, the resourceful, evaluative, maximising model of human behaviour, dominates that of all the other models'.[42]

The REMM model supports agency theory as it assumes 'maximising', which is consistent with the 'unlimited appetite' in the first row of 'Economic People' of Table 1. REMM is also consistent with 'Economic People' in row 3 in that 'Individual preferences are transitive – that is, if A is preferred to B, and B is preferred to C, then A is preferred to C'.[43] But as Wearing points out, individuals can change their minds over time to prefer A to B, B to C but C to A! This is an acceptance that, in reality, individuals can take opposing positions to exhibit the dynamics of tensegrity.

Wearing also recognised the dynamics of human nature by introducing cybernetics in row seven stating that 'Real People' 'stand in an interactive cybernetic relationship to his/her community and environment and is changed as a result or any interaction'. The dynamic view was supported by Kelso and Engstrøm[44] who reported: 'Experiments show that the human brain is capable of displaying two apparently contradictory, mutually exclusive behaviours at the same time'.

Kelso and Engstrøm introduced the tilde '~' notation, adopted in this article, to indicate the paradoxical dual contrary~complementary interdependent relationships present in our brains and many other contexts, including evolution[45] and the universe.[46]

The REMM model is static like the other models considered by Jensen and Meckling. In addition, in row eight of Table 1, 'Real People' are characterised by 'Differences between individuals are significant and important'. This means the assumptions of agency theory, which are based on the REMM model, cannot apply to everyone, and when they do, they cannot be relevant for most of the time in a dynamic world that recognises the existence of tensegrity.

Recognising tensegrity undermines Coase and Williamson's assumption that firms involve a 'master and servant' or 'employer and employee'[47] authority system as found in command and control hierarchies. Williamson noted that he was not concerned with worker cooperatives like Mondragon.[48]

As command and control hierarchies dominate public, private, non-profit and government organisations, there has been no widely accepted theory of all other types of firms and social organisations. Examples are partnerships, cooperatives, mutuals, incorporated joint ventures, associations, and those that mimic the self-governing processes in traditional Indigenous[49] societies, nature and other species.

Extending the theory of firms to any social organisation of any species

The Coase explanation of why firms exist can be explained in terms of market failure. Markets did not exist to supply complex components of novel goods and services; if they could evolve, they were too costly. The cost of using markets to create products could be greater than the cost of employing workers. It was quicker, simpler and more certain to employ a servant to make them

42. Jensen and Meckling, 1994, p. 33
43. Ibid, p. 4
44. Kelso and Engstrøm, 2006, p.120
45. Smuts, 1926, p. 59; Ingber, 1998, p. 39; Mathews, 1996, p. 50; Hock, 1999
46. Bohm, 1980, Ingber, p. 39
47. Coase, 1937, p. 13
48. Williamson, 1975, p. 265
49. Turnbull and Poelina, 2022, p. 29-30

than to buy them. This led Williamson to develop transaction cost economics (TCE) as a theoretical basis for investigating firms organised as various types of command and control hierarchies.

The idea of using 'transactions' as a 'numaire of analysis' was suggested 14 years before the science of cybernetics was established in 1948.[50] Costs cannot be defined in terms of any one or more tangible things, and the difficulty in identifying and/or defining all transactions compounds the lack of rigour of TCE.

TCE is subsumed and extended by transaction byte analysis (TBA) with increased rigour. Bytes are perturbations in energy and material that makes a difference that can be objectively metered. It establishes 'the science of governance'[51] and 'the science of corporate governance'[52]. TBA allows any social organisation to be analysed of any species, as indicated in Table 2, 'Comparison of TCE and TBA boundaries'.[53]

TABLE 2: COMPARISON OF TCE AND TBA BOUNDARIES[54]

	FRAMEWORK OF ANALYSI →	TRANSACTION COST ECONOMICS (TCE) (Coase/Williamson)	TRANSACTION BYTE ANALYSIS (TBA) (Developed by the Author)
1	Type of social institution	For-profit firms, not labor managed	Any social organisation of any specie including any type of firm
2	Subject of analysis	Transactions and their costs	Biota/people and the quanta (bytes) of data they can receive, process, store, retrieve, use and/or transmit
3	Relationship of biota (people)	Master/servant or competitive	Any e.g., family, cooperative, competitive, associative, etc.
4	Biota behaviour	Self-interest	Any e.g., altruistic, self-interest, etc.
5	Objectives	Economising costs	Anything (for firms, economising the transaction of bytes by people while compensating for errors with redundancy)
6	Basis for objective	Normative	Physiological and neurological limits in transacting bytes
7	Modes of governance	Markets, hierarchies, or hybrids of both	Any combination of clans/communities, associations, hierarchies and/or markets
8	Communication and control through:	Markets and hierarchies	Senses, semiotics, language, geometry, positioning of biota and their numbers
9	Firms exist because:	Markets fail to provide cost reducing components	Two or more people can reduce 'bounded rationality' and allow specialisation in abilities and/or knowledge and/or wisdom

50. Commons, 1934, pp. 4-8
51. Turnbull, 2008
52. Turnbull, 2002
53. Turnbull, 2000b, updated version of Table 7.1, p. 255. Turnbull, 2014b, updated version of Table 7.1, p. 336
54. A comparison of TBA and other theories of the firm are presented in Table 7.3 of Turnbull, 2000b, pp. 266-7 and Turnbull, 2014b, pp. 349-50

TBA provides a methodology for grounding the analysis of decision making, communication and control within and between any life forms, including plants or physical processes in the universe.[55] Plants draw attention to how the growth architecture can be governed by changes in the shape and configurations of their parts. As Ingber[56] pointed out, stresses observed by one part of a structure that possesses tensegrity, like a cell, are communicated throughout the entire structure to change its shape, changing its function for the system in which it operates. TBA also provides a basis to apply the law of requisite variety to identify the inherent limitations of hierarchical organisations, as is next considered.

OPERATING PROBLEMS OF HIERARCHICAL ORGANISATIONS

Four systemic dysfunctional physical problems can be identified in simple centralised command and control hierarchies.

1. Data overload by centralised decision makers without error-correction mechanisms, leading to delegation and the implementation of decisions to subordinate levels to form a hierarchy and additional problems outlined below.
2. Data losses, biases and distortions from subordinate level feedback without error-correction processes.
3. Discretional interpretation by subordinates in determining the details of how to implement superior-level communications without error-correction processes.
4. No systemic external feedback channels to detect mismanagement, misconduct and malfeasance independently of those responsible.

In addition, at least five behaviour problems can be identified arising from the power relationships in simple centralised command and control hierarchies. These are as follows:

1. Centralised decision-making introduces absolute power for decision-making individuals to identify and manage their conflicts of interest to corrupt themselves, their organisation, its stakeholders and society.[57]
2. Blind obedience to authority by subordinates creating 'group think'[58] to deny adequate variety of reliable feedback.
3. Excess exploitation of subordinates to alienate them as loyal cooperators and as reliable communication and/or control agents.
4. Behavioural tensegrity by employees and/or agents is suppressed, inhibited, prohibited and/or punished to frustrate discovery of superior operating processes.
5. Behavioural tensegrity by the organisation is denied, frustrating identifying novel ways to adjust to complex dynamic environments.

Using authority as described above creates toxic[59] relationships to aggravate the systemic dysfunctional physical data processing described.

The above observations suggest two additional hypotheses:

> *Hypothesis 2:* **Tensegrity is frustrated, denied and excluded in centralised command and controlled hierarchies that become systemically subjected to 'group think' to reduce the organisation's ability to self-regulate, self-manage and self-govern like living things.**

55. Suggested by Bohm, 1980, and Ingber, 1998, p. 39
56. Ingber, 1998, p. 38
57. Acton and Fears, 1985
58. Fink, 2018
59. Carucci, 2018

> *Hypothesis 3:* Tensegrity is required in social organisations to provide a requisite variety of cross-checking decision making, communication and control facilities to reliably and comprehensively identify and control internal needs and external risks, threats and opportunities to its existence.

Here the dual nature of holons becomes relevant. In discussing holons, as both a 'part' and a 'whole', Mathews introduced the work of quantum physicist Bohm.[60] Mathews stated that 'like Smuts before him, Bohm departed from the conventional view that sees systems composed of the behaviours of its parts (e.g., electronic phenomena as being explained by the activities of electrons) was organised by the whole'.[61]

If cybernetics can explain why tensegrity is ubiquitous in biology, then Mathews' observations suggest that the role of tensegrity could be extended into the physical world. This leads to three speculative hypotheses below that were included in another article with a 'Table 2: Identifying dual behaviour of humans/biota/holons/holarchy and the universe'.[62]

> *Hypothesis 4.* For evolution to be maintained, new emerging entities or phenomena need to reproduce the dual paradoxical features of tensegrity to generate a requisite variety of novel conditions to arise in different contexts for the process of evolution to continue.

> *Hypothesis 5.* Evolution could not have commenced unless tensegrity emerged with time, with both becoming embedded in all matter and energy.

> *Hypothesis 6.* The disappearance of time with its paradoxical dual complementary phenomenon of tensegrity is suggested by presence of dark matter and energy.

The phenomenon of tensegrity in individuals and organisations also seems to be a neglected or hidden topic. One explanation could be that management research is dominated by studies of publicly traded firms where hierarchical power structures inhibit their emergence from being detected.

Is behavioural tensegrity hidden and neglected?

The study of tensegrity could also be concealed because of the use of related but different words. Schumacher[63] introduced a more appropriate existing word, 'antinomy', in his chapter 'Towards a theory of large-scale organisation' when he referred to the antinomy of order and freedom. Management scholars Smith and Lewis[64] reviewed related literature on paradoxes that trace their origins to 'Yin~Yang'. Hock,[65] the founding CEO of the polycentric governed VISA card firm, coined the word 'Chaord' to describe the presence of tensegrity by combing the words 'Chaos' and 'Order'.

Hock describes the governance architecture found in nature that recognises the presence of tensegrity without using the word. Hock[66] described a 'Chaord' in two different ways:

1. Any self-organising, self-governing, adaptive, nonlinear, complex organism, organisation, community, or system, whether physical, biological, or social, the behaviour of which harmoniously combines characteristics of both chaos and order.

60. Bohm, 1980
61. Mathews,1996, p. 37
62. Turnbull and Poelina, 2022, p. 25
63. Schumacher, 1975, p. 209
64. Smith and Lewis, 2011
65. Hock 1999, Inside front cover
66. Ibid, p. 30

2. An entity where behaviour exhibits observable patterns and probabilities not governed by the rules that govern or explain its constituent parts.

Hock[67] described 'chaordic' in three ways:

1. The behaviour of any organism, organisation, or system that harmoniously blends characteristics of order and chaos.
2. Patterned in a way dominated by neither chaos nor order.
3. Characteristic of the fundamental organising principles of evolution and nature.

Hock[68] also identified the inherent problems of hierarchical organisations as described above by stating:

> **Industrial Age, hierarchical command and control pyramids of power, whether political, social, educational, or commercial, were aberrations of the Industrial Age, antithetical to the human spirit, destructive of the biosphere and structurally contrary to the whole history and methods of biological evolution. They were not only archaic and increasingly irrelevant; there was a public menace.**

There are various alternatives to hierarchical organisation forms. These are considered in the following section.

ALTERNATIVES TO HIERARCHIES

There are various alternative organisational design concepts to consider, like the 'viable systems model',[69] 'syntegrity',[70] 'sociocracy',[71] 'holacracy',[72] 'heterarchy',[73] 'polycentric governance'[74] and 'holarchy'[75]. Each describes some form of decentralisation with various degrees of bottom-up decision making. They all can provide valuable alternatives and adjuncts to simple hierarchies. Organisations incorporated as 'for benefit' or 'B corporations' remain a hierarchy. They do not remove the toxic problems identified above.

Syntegrity operates at the smallest scale, typically up to 30 individuals.[76] VSM involves a division of a firm with sociocracy used mainly for managing non-profit community associations. A holarchy and a heterarchy typically involve a whole organisation. Polycentric governance and holarchies may involve many organisations forming network relationships. A heterarchy[77] is itself a network of decision-making centres like a holarchy. What makes them different is that a holarchy is made up of holons by definition. A defining feature of a holon is that it possesses tensegrity to create another point of differentiation between a heterarchy, a holacracy and a holarchy. This also explains why hierarchies and a holacracy are different from a holarchy.

Holacracy is a business name used by a company incorporated as HolacracyOne in Pennsylvania[78] in August 2006 with limited liability. The corporation provides consulting services to introduce a distributed network management form registered in its bylaws[79]. It has a single board of directors representing its shareholders. Its bylaws introduce distributed decision-making with its staff who may also be its shareholders, but neither are its shareholders or other stakeholders, like its clients,

67. Ibid.
68. Hock, 1995, pp. 7-8
69. Beer, 1995
70. Beer, 1994; Espinosa, and Harnden, 2007
71. Rau, 2021
72. Robertson, 2015; Kettering, 2020; Holacracy, 2021
73. McCulloch, 1945
74. Ostrom, 2009
75. Mathews, 1996
76. Espinosa, and Harnden, 2007
77. IMPA, 2018
78. https://opencorporates.com/companies/us_pa/3665532
79. Holacracy, 2021

recognised in the bylaws. The bylaws are sufficiently flexible to allow idiosyncratic outcomes in its own success and that of its clients.

Bernstein et al.[80] and Velinov and Densisov[81] provide evidence that holacracy could provide useful auxiliary guidelines for the Ostrom Principles. Bodie[82] reports that Delaware Law would allow elements of holacracy and sociocracy to be recognised in corporate constitutions. This is no surprise. It reveals that scholars have neglected to note how the law in many jurisdictions around the world allows corporate constitutions and bylaws to introduce distributed decision making as reported by many researchers.[83]

Ostrom uses polycentric governance to describe when a CPR is managed by competing interests. However, it could also be used to describe heterarchical organisations that lack tensegrity. Such organisations could also be described as possessing 'network governance'[84] with and/or without competing interests.

Network governance introduces comprehensive engagement with influential competing stakeholder interests to provide a basis for developing an ecological form of governance found in living systems with the capacity to become self-governing. However, there is a global gap in knowledge and practice in evaluating, designing and transforming organisations to introduce self-governance. This gap exists with social scientists, not engineers and natural scientists, who already know how to design, build and operate self-governing automobiles and self-governing space exploration devices.

Filling the knowledge gap

Filling the knowledge gap requires integrating different contributions of theorists using different words to describe common phenomena. Mathews[85] reviews several pieces of literature in this regard. He identified how Smuts[86] introduced the concept of 'holism' in 1926. This is a feature that Simon[87] described and developed in 1962 by referring to 'sub-systems', 'able to maintain a separate existence', 'nearly decomposable systems in which the interactions among sub-systems are weak, but not negligible'. Simon was describing what is now conceptualized as a 'holon', a word introduced by Koestler[88] five years later. Koestler described a network of holons as a 'holarchy'. As described above, Hock coined his own word 'Chaord' to describe a holon.

While Mathews[89] does not use the word tensegrity, he identifies their dual contrary~ complementary characteristics when describing the behaviour of holons as possessing: 'Centralisation/decentralisation'; 'Bottom-up/ top-down'; 'Autonomous/integrated'; 'Order/ ambiguity'. He concludes that this behaviour is a defining feature of holons and the holarchies of which they are components. This makes holarchies radically different from all the alternative forms of organisations.

While Ingber[90] does not use the words holon or holarchies, he recognises their existence by referring to 'systems' and how our bodies are 'organised hierarchically as tiers of systems within systems'.

80. Bernstein et al., 2016
81. Velinov and Densisov, 2017
82. Bodie, 2018
83. Analytica, 1992; Bernstein 1980; Craven et al., 1996; Dallas, 1997; Hock, 1999; Turnbull, 2000b, 2014b, 2020; Whyte and Whyte, 1988
84. Pirson and Turnbull, 2011, 2015; Turnbull, 2003, 2007, 2013, 2014c, Turnbull and Pirson, 2012, 2019
85. Mathews, 1996
86. Smuts, 1926
87. Simon, 1962, p.468
88. Koestler, 1967
89. Mathews, 1996, pp. 52-3
90. Ingber, 1998, p. 30

Crucially, Ingber[91] notes that the 'rules of self-assembly' allow new emergent properties to arise that do not exist in the parts. In this way, he considers tensegrity as the design rules for building various life forms, consistent with the title of his article 'The architecture of life'. This provides another reason holarchies radically differ from other forms of organisations. It also suggests that tensegrity, like time, is an embedded feature of all matter and energy, as hypothesised in the concluding section.

Social scientists' knowledge gap about self-governance

This knowledge gap has been recognised by leading associations of scholars such as the Academy of Management (AOM) and the European Academy of Management (EURAM). The AOM accepted holding a 'Caucus'[92] to consider the knowledge gap at their annual 2021 conference, while EURAM held related symposia at their annual conferences in 2021[93] and 2022[94] with a follow-up one programmed for 2023.[95]

An earlier version of this article was presented at systems scientists' conferences and the EURAM 2022 conference. Nevertheless, for the EURAM presentation, the title was changed to make it more attractive for management scholars by removing the word 'cybernetics'. While the word 'tensegrity' would be mostly unknown, it would not have questionable connotations that can arise with the word 'cybernetics'. The title of that paper became 'Why is tensegrity a neglected organisational resource?'

Language is a problem in closing the knowledge gap about self-governance. Many words can possess ambiguous meanings. Ostrom[96] pointed out that:

'No scientific field can advance far if participants do not share a common understanding of key terms in their field'. Even the words 'systems' and 'scientist' are part of the problem. A dictionary definition of a 'scientist' is 'a person who is studying or has expert knowledge of one or more of the natural or physical sciences'. This excludes social activities like management and economic systems being scientific unless they can be defined by some physical metric.

Definitions of a 'system' can include dominant social metrics like prices, costs and profits that represent social constructs not defined by any one or more real goods or services. This denies rigorous feedback communications or reliable management of problems if no physical metrics are available to provide undisputable objective analysis. Without physical metrics, social systems lack processes to understand any physical limits introduced by the insights from the science of cybernetics, defined as 'control and communication in the animal and the machine'.[97]

This cited definition excludes control and communication *external* to an animal and a machine. So, a new definition is required if we wish to apply cybernetic insights to the social activities of any living thing. Something along the lines of 'control and communication within and between biota and human-created devices'. These words provide a definition for 'the science of governance' cited above.

The need to involve 'communications' within and between entities introduces the need for transmitting, receiving and processing data. As noted above, data possess metrics described as bytes. Problems arise from using the word

91. Ibid
92. AOM, 2021
93. EURAM, 2021
94. EURAM, 2022
95. EURAM, 2023
96. Ostrom, 1986, p.4
97. Wiener, 1948

'information' to describe data when many people use the word 'information' as referring to meanings, knowledge and/or wisdom. There are no physically based metrics for such social constructs, just as there are no physically based metrics for economic value, costs or prices.

These social constructs are not required by flora, fauna any other types of life to become self-governing. The challenge for humans is to adopt natural practices and natural scientists' use to design self-governing devices. The communication, control and data processing systems in biota share identical data metrics as humans in the form of bytes.

Humans' physiological and neurological limits to transact bytes are now known and provide design criteria for how they may be best connected to achieve self-governance without needing metrics for meanings, knowledge and wisdom. This is because no change in these social constructs can occur without transacting bytes.

CALL TO ACTION

In suggesting a call to action, we need to consider the first pioneering application of cybernetics to management described above as VSM as a starting point. Beer introduced the VSM in his 1972 book that became so widely read it was republished in 1981. It is perhaps the most accepted attempt to apply systems knowledge to management. However, it failed to be widely adopted in practice. This was because its success depends upon managers' discretion and support from a higher authority like a board of directors.

Beer had been oblivious to the architecture of power in modern organisations. He advised me of this in person on 3 August 1996 after reading the paper[98] I was presenting in Toronto. He said that he had never engaged with corporate governance. It was only around that time that the crucial role of governance was beginning to become recognised. Likewise, humans' physiological and neurological limits to transact data and information, knowledge and wisdom had yet to become widely acknowledged as a criterion for designing self-governing organisations.[99]

Even today, no known education institution provides education on how to design the constitutions of organisations to provide operating advantages.[100] The first course in the world to do so was a 40-hour MBA elective at Macquarie University Graduate School of Business in Sydney in 2003 and 2004. The course was designed and presented by my PhD supervisor Prof James Guthrie and me. Part[101] of this course was adopted by Columbia Law Professor Katharina Pistor in a postgraduate law course she taught at the Swiss International Law School in 2015.[102]

There appears to be a mindset that corporate constitutions are irrelevant to managers, governance scholars or society. However, the 2018 call by the biggest investor in the world, holding around 10% of all global equities by value for 'A new model of corporate governance'[103] might provide an incentive for individuals to seek this knowledge to learn how a new model might best be designed and so for scholars to deliver such knowledge. This incentive was reinforced by the CEOs of the US Business Round Table (BRT)[104] in 2019, to adopt as their corporate purpose to 'provide benefits for all their stakeholders'. At present, they lack a credible model of governance to achieve their purpose[105].

98. Turnbull, 1997
99. Turnbull, 2014a
100. Turnbull, 2000a
101. Turnbull, 2015
102. Pistor, 2015
103. Fink, 2018
104. BRT, 2019
105. Bebchuk and Tallarita, 2022

A political initiative may be required to initiate change, as suggested in my book,[106] articles[107] and a working paper, 'Do we need a new model of corporate governance?'[108] It describes a self-funding tax incentive for shareholders to introduce stakeholder capitalism to achieve the BRT purpose. The tax benefit requires shareholders to change corporate constitutions in three ways:

1. Shareholders transfer a small fraction of their equity each year to a new class of stakeholder shares. This allows the ownership of corporations to be localised in each bioregion of the planet in which they operate by endowing resident citizens with stakeholder shares. Corporations can then become responsible for protecting and nurture the host environments of their stakeholders.
2. A division of corporate powers is introduced. Shareholders elect one board to manage the business and a second board to govern the corporation. Unlike the European two-tiered boards that appoint the management board, this simplifies directors' duties and removes their dysfunctional conflicts of self-interest in determining their own nomination, remuneration and audit. It also introduces tensegrity as the governance board is elected democratically to introduce constructive tensions with managers elected on a plutocratic basis, but whose pay and appointment are determined democratically.
3. Corporate constitutions introduce tensegrity between stakeholders and managers, allowing each stakeholder constituency to elect and resource its own advisory board providing key performance indicators for the Board of Governors on how well the management board are delivering stakeholder benefits. Shareholder primacy is maintained that now includes stakeholders. Stakeholders become co-regulators to facilitate self-governance to reduce the role of government.

The working paper provides operating details with a literature review of ten different ways of introducing 'a new model of corporate governance'. Some authors raised concerns about applying the Ostrom Design Principles directly globally. However, these can be overcome by taking the indirect approach to amplify regulation indirectly by corporations becoming 'supplementary'[109] co-regulators of the complex, interrelated variables degrading the global commons locally.

Endowing voting citizens with equity creates a compelling incentive for elected politicians with competing interests to support a tax incentive for investors to lead the introduction of stakeholder capitalism. Citizens typically pay higher taxes than corporations so that the tax incentive can become self-funding. Localising ownership also enriches the host country by reducing obligations to foreign investors.[110]

The endowment of citizens with corporate shares creates a process to build a universal wellbeing income for citizens. It provides a way to privatise the welfare system with less tax, less welfare and smaller governments. Compelling self-reinforcing incentives are created for political leaders, investors, CEOs and citizen voters to transform corporations and enrich democracy locally with citizen voices from the bottom-up of the firms that affect their wellbeing.

CONCLUDING REMARKS

The phenomenon of tensegrity was first identified in the 1950s by Buckminster Fuller in the sculptures of Snelson.[111] Fuller used tensegrity to create geodesic domes that covered the most significant area with the least material. Ingber noted that 'tensegrity structures offer a maximum

106. Turnbull, 1975, Appendix
107. Turnbull, 1997, 2011, 2014a, 2020, 2021c, 2022a; Turnbull and Poelina; 2022, Turnbull and Myers, 2017
108. Turnbull, 2021a
109. Ashby, 1956, p. 244
110. Penrose, 1956, p. 235
111. Snelson, 2012

amount of strength for a given amount of building material'. The theoretical contributions of this article follow up the observations of Fuller and Ingber to suggest that:

1. behavioural tensegrity provides biota with the ability to minimise its DNA to reproduce;
2. behavioural tensegrity provides biota an efficient way to become self-governing;
3. self-governance of organisations is dependent upon them possessing tensegrity;
4. tensegrity is frustrated or denied by hierarchies to deny self-governance;
5. tensegrity reveals models of human behaviour used by many scholars are not realistic;
6. tensegrity in social organisations drives adaption to sustain their survival;
7. organisations with tensegrity enrich democracy with inclusive participation by citizens;
8. transaction byte analysis provides a methodology for researching the hypotheses;
9. the science of cybernetics is extended and subsumed into the science of governance;
10. tensegrity, like the arrow of time, is an embedded emergent feature of the universe.

The practical contributions of this article are to identify how to:

1. design self-governing organisations;
2. apply the self-governing design principles of Ostrom to corporate entities;
3. transform corporate entities to become a CPR providing benefits to all citizens;
4. create a tax incentive to transform corporations to become a CPR;
5. make the tax incentive self-financing to accelerate stakeholders replacing shareholders;
6. build a universal wellbeing income for bioregional citizens to reduce government;
7. create CPRs to become global agents to counter local environmental degradations;
8. transform capitalism to establish bioregional circular eternal self-governing societies.

Research opportunities arise from the hypotheses raised in this article, with TBA providing a framework for their investigation. As bytes are ubiquitously and routinely disclosed on most electronic devices, there are many opportunities for using TBA as a research tool to investigate many other questions that social scientists may raise. As TBA can be applied to any biota, it could also be used to evaluate and compare the social behaviour within and between diverse forms of biota. The opportunity exists to replace bytes with qubits to consider complex relationships at the quantum level.[112]

This article has also identified how tensegrity and the ability of organisations to become self-governing is a neglected topic of scholarship and practice with social scientists and practitioners. However, natural scientists have applied this knowledge to design, build and operate self-governing automobiles and space exploration vehicles.

While academics[113] have identified that 'Climate change is the most important mission for universities of the 21st Century', there is little evidence of this being recognised. While members of leading academic associations cited above have recognised a global knowledge gap in how to introduce bottom-up stakeholder-governed organisations, universities understandably resist committing their resources to sources of knowledge not created by them.

Ways of overcoming this collective academic inaction depend on their staff's informal initiatives and institutional reaction to practitioner-led initiatives. Practitioner-led initiatives have been

112. Turnbull and Poelina, 2022, p. 42
113. https://theconversation.com/climate-change-is-the-most-important-mission-for-universities-of-the-21st-century-139214

noted in this article, such as the US Business Round Table seeking to make their corporations a CPR to provide benefits for all their stakeholders. Also, the call from one of their members for 'A new model of corporate governance' to turn corporations into a CPR.

The conversion of established corporations into CPR organisations will likely require each to be custom designed. There are so few precedents in custom designing self-governing organisational architecture, so this may most likely require learn-by-doing processes. While this article has identified various design principles, their application could be a matter of art[114] informed by trial and error.

A critical complementary skill to guide and expedite a learn-by-doing process is the development of techniques for assessing the integrity, quality, variety, response times and coverage of corporate channels of communication, control and decision-making required to achieve self-governance.

To develop this skill, the cohorts in those 2002–2003 MBA elective classes, mentioned earlier, were divided into three-person syndicates. Each syndicate developed and presented its own rating system to be compared and critiqued by its peers. They could then modify their self-governance rating systems to re-rate the case studies they had selected for introducing improvements. Each other syndicate would then use their rating systems to evaluate how recommended changes to corporate charters and bylaws might improve. In this way, each syndicate was exposed to a variety of case studies, self-governance rating systems and techniques for improving self-governance.

The shared learn-by-doing re-iterative processes with built-in 'trim tab'[115] feedback corrections described above would remain valid today. Readers interested in co-inventing an education program for self-governance architects are invited to join an online discussion group by contacting the author. When there is an interest in filling the gap in knowledge and practices of transforming capitalism to become eternally sustainable, this article could provide a resource for developing this objective.

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RESARCH NOTE

PROVIDING EVIDENCE OF THE IMPACT OF UNIVERSITY RESEARCH

Prof Christian Nielsen

Universities are under increasing pressure from funders and taxpayers to maximise the benefits of their research programmes and deliver value for money. Prof Christian Nielsen, the Head of Aalborg University Business School, offers recommendations on how to conceptualise, articulate and communicate the value and impact of academic research to university stakeholders.

INTRODUCTION

To make an impact, or to have an impact, is a question of conducting research that makes a difference and influences someone or something. The impact of universities' research can be defined as the long-term effects of the outputs created. Making an impact is at the core of universities' 'third mission', with the first and second missions being research and education. The impact of university research and education has become an objective for universities across all disciplines. This third mission focus is reconfiguring the relationship between universities, the state, the private sector and society.[1]

From a global perspective, universities are being compared and ranked more than ever for their research quality and third mission activities. In the EU, the *Horizon Europe* program focuses on academics' contributions to solving grand challenges and achieving missions. It uses a revamped indicator framework built around a set of Key Impact Pathways, including scientific, societal and economic measures.[2] The UK has an established research assessment process, the Research Excellence

1. Gunn and Mintrom, 2022
2. Bruno and Kadunc, 2019

Framework (REF), which aims to secure the quality of research outputs. An element in the process is assessing reach and significance, meaning the impact of a particular piece of research across a wide range of areas.[3] There is an increasing focus on impact in research assessment exercises, particularly across continental Europe and Australasia, where New Zealand's Performance-based Research Fund is a prime example. Australia's Excellence in Research for Australia (ERA) is undergoing revision for the 2023 exercise.

Academics are incentivised to publish their work in high-quality journals and actively enhance the number of citations received. Doing so engages with the scholarly community and influences other academics' work. These aspects are also the basis of career assessments. On an individual basis, researchers measured by their H-index. However, while valuable, such indicators do not fully capture the broader influences of research outputs, that is, impact. Research assessments in several countries have begun determining funding distribution to universities, increasingly using evaluations of influence, reach and making a difference to society in their distribution mechanisms, as is the case in the EU's framework programs.

Therefore, focusing on enhancing the potential impact of research will, in due course, positively affect universities' budgets. The UK REF in 2019[4] provides several examples of potential impacts, including research that leads to enhanced disease prevention, measurable by evidence of enhancing patient experiences. Other research impacts could include generating new ways of thinking that influence creative practices, developing policies that alleviate poverty or enhance sustainability, and creating spin-offs and new businesses that generate revenue or profits. Research is recognised in the REF as contributing to innovation and entrepreneurial activity by designing and delivering new technologies, products, services and business models. These are just a few examples of research's potential impacts and demonstrate that impacts are not simply equivalent to publications or citations.

The critical point is that no universal measure of impact exists. However, the notion of impact in a broader sense is set to become even more crucial in the future, regardless of university managers' academic discipline or performance management system.[5] This research note aims to clarify the terminology around impact, including applying phrases typically used in funding programs, such as exploration, commercialisation, valorisation,[6] and sustainability of actions. In the critique of this focus on research impact and value for money, let it be noted that expecting all types and categories of research to somehow, at the time of their production, be potentially connected directly to impacts is an unrealistic idea that may even threaten the foundation on which universities stand. Therefore, we must be careful that focusing on impact and the third mission does not overlook funding for basic research and academic freedoms.

DEFINING THE IMPACT

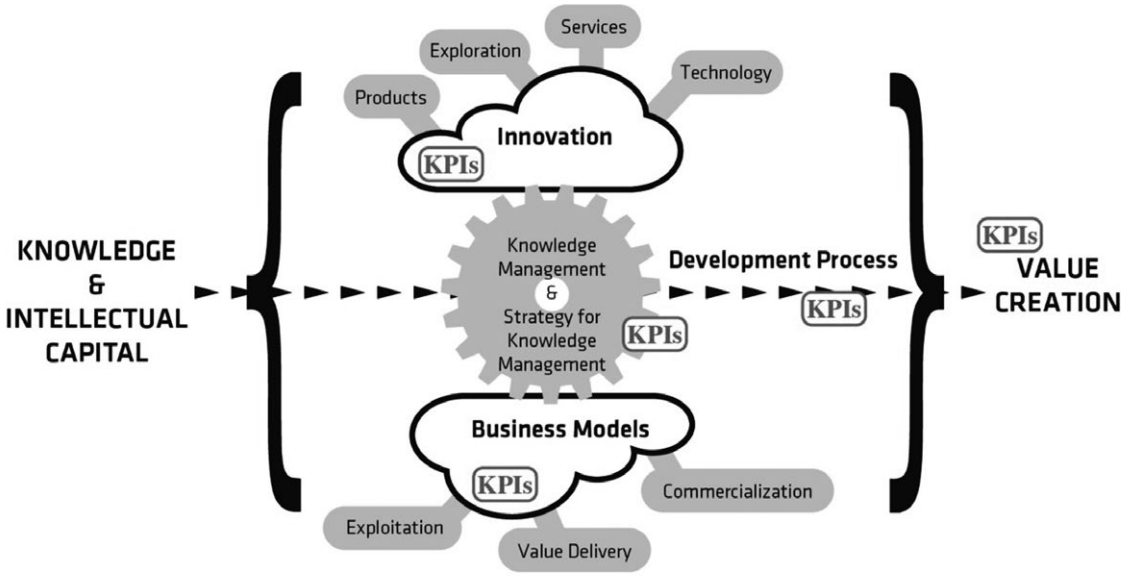
For university research, the impact is synonymous with the notion of *contribution* and is related to the advancement of knowledge and the reach and significance of this knowledge advancement. The impact is defined as the last stage along three dimensions: outputs, outcomes and impacts. Here, outputs are the direct, measurable results of inputs and activities and may constitute different types of results; some more qualitative and some related to interpretations of previous research results. Examples of outputs are analyses, demonstrations and other prototypes, software programs, databases and publications. Outputs are often difficult to relate directly to impacts because they must first be translated into outcomes.

3. REF 2019/02
4. REF 2019/02
5. Martin-Sardesai et al., 2020
6. Valorisation – the act of thinking or stating that something has value or is valuable.

Outcomes are what the outputs achieve, for example, by assessing the output in terms of its short- and long-term effects on stakeholders. An outcome is thus how a given innovation addresses a problem for a given stakeholder. In the short term, for a researcher, this could be access to global real-time data on water temperature; for a patient, it could ease the phantom pain of a missing limb. Hence, the impact is reflected in the long-term effects and outcomes of each research output. In the two examples above, the associated impact is, in the former case, the ability to construct more valid weather-prediction models that increase farming productivity and, in the latter case, a better overall quality of life. Output and outcome are measurable effects and can be helpfully distinguished when formulating key performance indicators (KPIs).

As a critique of the causal output-outcome-impact model, Nielsen[7] articulates that research and innovation outputs have many possible forms, for example, products, exploration, services or technologies. Some of these dimensions and their relations are illustrated in Figure 1. Ensuring that research makes a difference (has an impact) requires that it becomes adequately captured, anchored, measured, managed and developed.[8] Outcomes relate to the effects of outputs on stakeholders (i.e., users, customers and the broader set of stakeholders).[9] Outcomes can be exploited, value-enhanced or commercialised through business models. In this sense, Figure 1 captures impact through the notion of value creation. This entails considering the long-term effects of the research on, for example, work-life

FIGURE 1: KPIS IN A VALORISATION PROCESS (NIELSEN, 2019)



7. Nielsen, 2019
8. OECD, 2010
9. White, 2009

balance, quality of life, the environment, the business environment and society.[10]

Examples of impacts of research that the broader society and business environment might desire might include enhancing future innovation and research capacities, creating new market opportunities, strengthening competitiveness and the potential growth of companies, addressing issues related to climate change or the environment; and developing other benefits for society and the wellbeing of citizens. Many of these aspects directly relate to creating value for specific stakeholders. Evaluators in funding bodies such as the EU will require the notion of value to be framed and defined.

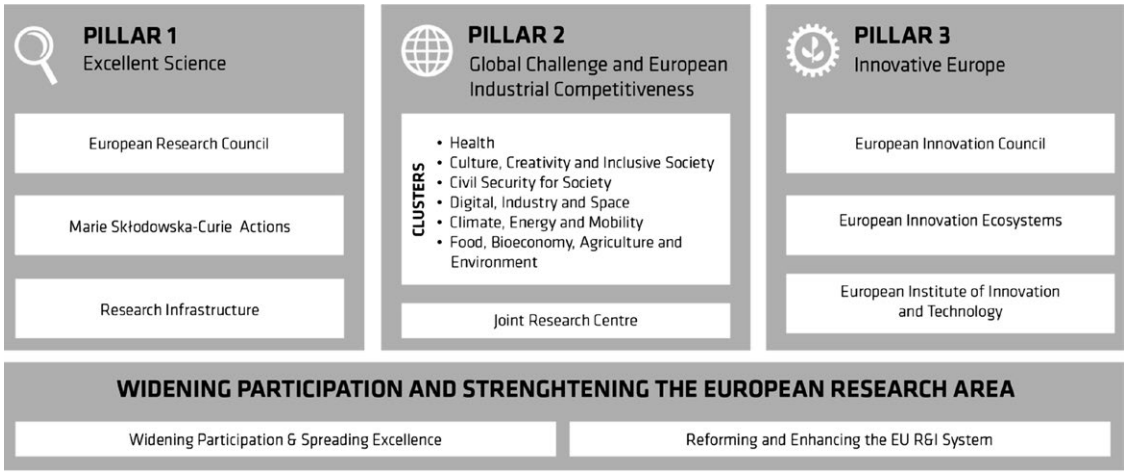
BREAKING DOWN HOW IMPACT CAN BE ACHIEVED

This section provides insights into how governments and funding bodies perceive impact work packages to be organised, and links to a *Horizon Europe* program case in section 4.

In contemporary research-funding programs such as *Horizon Europe*, an additional and mandatory condition is the inclusion of a plan for valorising a project's results, including proposed KPIs that will help achieve the project's expected impact. Applying the Marxist idea,[11] valorisation is the increase in the value of capital assets through the application of value-forming labour in production. Such a valorisation plan should typically contain measures implemented during and after the project.

Focusing on the *Horizon Europe* framework illustrates the central links between outputs, outcomes and impacts. In the current program, the impact will underpin the evaluation metric deployed across the three funding pillars depicted in Figure 1: 1) *excellent science*; 2) *global challenges and European industrial excellence*; and 3) *innovative Europe*. *Horizon Europe* thus exemplifies a funding scheme with a mission-driven approach that links critical societal challenges and relevance

FIGURE 2: ***HORIZON EUROPE*** FRAMEWORK PROGRAM (EUROPEAN UNION, 2019)



10. Nielsen *et al.*, 2019
11. Marx, 2004

to a broad range of stakeholders, including citizens, to an 'investment mindset' and project portfolio approach at the supra-national level.[12]

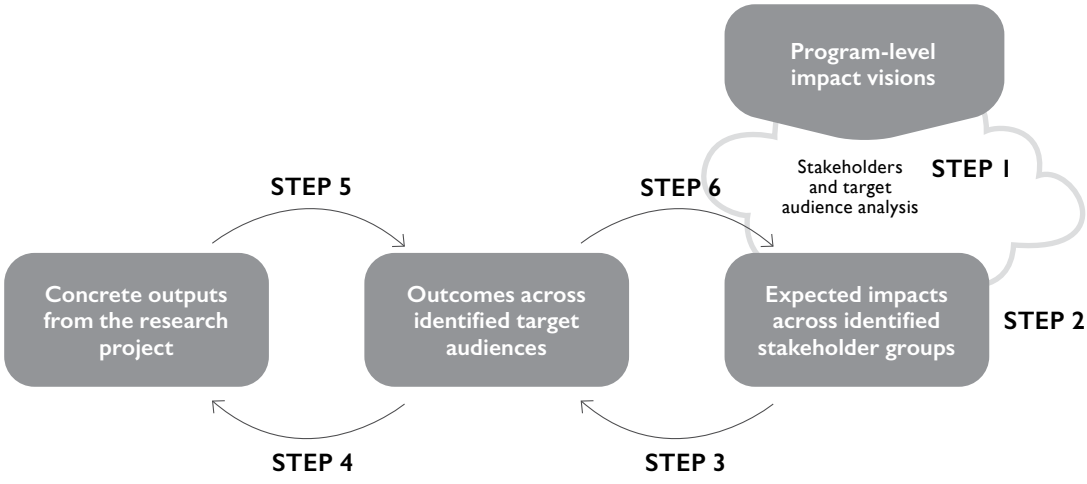
The *Horizon Europe* program focuses on impacts by distinguishing between *expected impacts* and *measures to maximise impacts*. These are now considered separately in the context of outputs, outcomes and impacts. The *Horizon Europe* program explicitly states that proposals should address impacts using quantified indicators and targets; furthermore, creating value from innovation should be underlined by relevant performance measures.

Horizon Europe defines expected impacts on a program level for each specific topic. Thus, the first objective is to describe how the project contributes to those impacts on which the EU wishes to focus. The EU states that the 'plan for disseminating and exploiting the project's results (in the form of outputs and outcomes) is key to maximising impact. This plan should describe, concretely and comprehensively, the area in which you expect to make an impact and who are the potential users of your results'.[13] This value-for-money perspective means that impacts ultimately must lead to value creation and delivery to recipient stakeholder groups while aiming to capture value. In other words, the designated solutions should be complemented with a viable, sustainable and potentially profitable output model, also known as a business model.[14]

Analysing and improving the impact

Evaluators seek to validate expected impacts by linking them with proposed outputs and outcomes. One way to improve impacts is to identify recipient stakeholders who will benefit from the outputs and outcomes. Alongside expected impacts, it is also possible to identify potential problems, risks or lost opportunities from not achieving impact. This analysis should include how each potential receiving stakeholder sees benefits and costs. Subsequently, the

FIGURE 3: PROCESS OF TRANSLATING IMPACTS INTO RELEVANT OUTPUTS AND OUTCOMES



12. European Union, 2019
13. European Union, 2019, p. 3
14. Shakeel et al., 2020

expected outputs and their associated outcomes can be described. Figure 4 offers a seven-step process through which universities can work on improving the connections between outputs, outcomes and impacts. If necessary, steps 2 to 7 can be repeated in the light of new insights into any element of the process.

Designing for life after funding

On a societal level, the transformation from an invention society based on technologies, products and patents into an innovation society is significant. It is also crucial that more innovations survive through the Valley of Death.[15] For this to occur, innovation must be considered a more integral part of the value propositions of research projects. Chesbrough[16] argues that 'a mediocre technology pursued within a great business model may be more valuable than a great technology exploited via a mediocre business model'.

Designing for a 'life after funding' in the *Horizon* program context is called *sustainability of action*. A plan for sustainability of action should outline how a project will be sustained until it leaves the funding scheme. This could be by ensuring it is mature enough for commercialisation or another round of funding and may require further research and development, such as broader testing or refinement of outputs to form a developed technology or business model. Such improvements will most likely require additional investments, sponsorship or donations. Prospective exploitation may also need a set of other conditions to be satisfied, including the adoption or adaptation of regulations, the diffusion of results and technologies into certain value chains, or public reception of the results. A sustainability plan's objective is to ensure that the output will lead to some form of value creation for society.

This sustainability plan could include elements such as technology maturity, for example, using a relevant capability maturity model[17] and an assessment of the current maturity of the expected research output in this context. An assessment of commercialisation in terms of the quality and maturity of the output may include a depiction of how the chasm between early adopters (technology enthusiasts and visionaries) and the early consumer majority (pragmatists) can be bridged.[18] Alternatively, securing investment capital for commercial purposes from an initial position of limited funding will be handled.

AN EXPLOITATION WORK PACKAGE EXAMPLE

This section exemplifies how an exploitation work package undertaken in a *Horizon Europe* program was organised. *Exploitation* refers to how the benefits of the research can be maximised, for example, by selling the generated intellectual property or relating a company around it. Note that the design of exploitation strategies is highly dependent on the type of project and the output produced, whether these are supporting infrastructures, data, tools, models, technologies or solutions. Research projects vary in type and focus, meaning their outputs foster different types of potential exploitation. Types of output from university research could include any of the following:

- preliminary investigations and pilot studies;
- ground-breaking research and exploratory studies;
- models that explain phenomena;
- tools that apply to processes;
- solutions that embrace multiple perspectives;
- empirical testing and validation of data and datasets (e.g., related to technologies or models);

15. Gomper and Lerner, 2001
16. Chesbrough, 2010, p. 354
17. Paulk et al., 1993
18. Moore, 2002

- new technologies;
- supporting infrastructures;
- demonstrations, showcases and minimum viable products;
- prototypes;
- use cases of prototypes and beta versions;
- production-ready products and services.

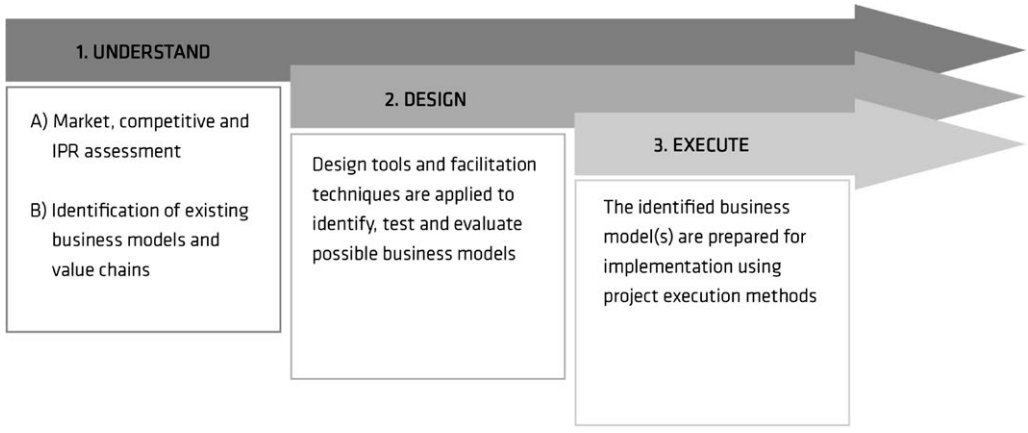
The type of exploitation necessary will depend upon the potential value propositions of the outcomes, which again depend on the targeted stakeholders. Often, a portfolio of actions must be designed to foster valuable outcomes. Such actions include sampling critical stakeholders in a business ecosystem to explore potential users' needs, co-designing interfaces with potential users, and gathering usage data on technologies or models adapted to local contexts and tested locally. Exploitation set-up depends on the maturity level of the output, for example, whether it is in the format of an idea, an innovation or a working prototype. In one completed project, the exploitation work package was guided by the question: 'How can it make money from the technological solutions and related Intellectual Property generated through the project?'

To answer this question, it was first necessary to understand the competitive landscape of the industrial setting where these technologies would be deployed and the business models currently being applied in the relevant industries. The next step was to study how the IP created in the project was of value to (i) users of the technological solutions and (ii) other potential corporate stakeholders.

The objective of the exploitation work package was to develop a sound set of business models around the technologies being developed. This research phase consisted of three primary stages: 1) understanding, 2) designing, and 3) implementing. These dispersed across two periods throughout the project. The initial understanding stage was addressed in the early stages of the project in order to identify possible models for structuring the exploitation objectives. The resulting knowledge was fed back into the parallel clinical development phases through the status reports shared in the project.

The **understanding phase** consisted of two parts. First, quantitative desk-research-based assessment exercises were undertaken, including a market assessment and an intellectual property rights

FIGURE 4: THREE GENERIC EXPLOITATION PHASES



(IPR) assessment. The market assessment included analysing and evaluating potential market sizes and the potential for profit, growth and competition, with macroeconomic and political factors also considered. Next, consideration was given to a more qualitative assessment of the existing business models applied in the market, the qualitative aspects of the applied revenue models, preliminary customer insights and analysis of value chain structures and strengths. This understanding phase provided a detailed overview of the environment where the technologies would eventually launch. It is essential to be explicit about these factors while developing new products.

Next was the **design phase**. This was primarily based on qualitative methods and utilised interventionist and non-interventionist studies. Initially, a reference group comprising potential users, developers and professionals in the industry was established. The design phase was facilitated through a series of workshops that combined design thinking techniques, documentation, external experts and tools to assist in identifying innovative business models. The central tools were value propositions, customer insights, business model canvasses, stakeholder maps and motivation matrices. The identified business models were tested at the outset of this phase using a springboard and investor panels.

Finally, in the **execution phase**, the identified business models were adjusted, optimised and prepared for implementation to develop concrete exploitation strategies for the technologies. This phase involved the development of detailed plans for the business and execution of the project, including the organisation of the resulting company, responsibilities of partners and identification of the competencies deemed necessary to its financial viability.

The three phases of the exploitation work package described here led to six specific tasks with two milestones, one for the early stage and one for the later stage.

Task 1: Market assessment

Assessment of market size, profitability, growth potential and the competitive landscape.

1. Preliminary market assessment
   An early, preliminary assessment of the market and IPR situation for specific technologies was carried out. This provided up-to-date information to help define a clinical protocol and refine the technologies.
2. Updated market analysis was completed, and exploitation strategies were developed.
   The value chain updated IPR situation and market (size, trends, opportunities, and end users' needs and interaction) were analysed. Each partner's specific exploitation plans, strategies and potential business models were developed.

Task 2: IPR assessment

Task 3: Evaluation of existing business models

This entailed evaluating existing business and revenue models and generating preliminary customer insights, value chain structures and strengths.

Task 4: Design and execution of potential business models

This entailed the design and testing of potential business models and the development of business model execution plans.

Task 5: Assessment of the exploitation potential of the involved companies, assessment of potential business models and the requirements for testing, and the development of execution plans for the models.

Task 6: Development of a business plan, including spotting the business opportunity, analysing the market space, providing a company overview, and describing the financials and the execution plan.

IMPLICATIONS AND CONCLUSIONS

This research note aims to raise awareness of the need to reflect on the impact of research and its integral part in universities' third missions. The stark reality of academia is that public and private funding sources increasingly emphasise value for money. This applies whether research is funded by universities or external sources. The fact is that funding bodies are increasingly looking to fund research projects and innovation activities that can make a 'real' difference. Evaluators of project proposals (and academics themselves) are looking for the 'reach and significance of impacts on the economy, society and/or culture that were underpinned by excellent research' (REF 2019/02, pp. 52). In addition, they want to ensure that research projects deliver on their aims and that the money invested creates actual returns. In other words, they want to have their cake and eat it too!

The breakdown of impact work provided in Section 3 illustrates that value creation is central in an impact-oriented paradigm (recalling its relatedness to performance and value for money). Therefore, when identifying impact, it is helpful to use a framework that ensures coherence between outputs, outcomes and impacts and to identify KPIs that are anchored across three dimensions; they should reflect: 1) the resources that go into the process; 2) the actions and activities performed, and 3) the effects of these.

Awareness of the contemporary evaluation paradigm is vital as its influence on what counts as meaningful research and research with impact continues to grow. The objective here has been to describe the processes involved in this transformation. It is essential to understand that evaluators are seeking projects that identify and deliver on clear and concise impact measures.

An important insight for policymakers and evaluators is that addressing valorisation processes and designing viable business models should not be left until after a research project has been completed. Instead, business development processes should be integrated concurrently and iteratively into research projects to ensure valorisation. This advice should be included in the guidelines provided by funding bodies or at least be mentioned in evaluation guides.

It is advantageous for evaluators to receive structured accounts of the expected impacts of a project. The impact analysis should list expected impacts and their qualities, matching impacts to specific stakeholders and what they value. For each expected impact type, the benefits of achieving it and the potential risks and costs, if it is not completed, should be explained from the perspective of each stakeholder. Those evaluating the potential impact of research should be helped in validating the connections between the proposed outputs and their desired outcomes and impacts and relate them to the impacts identified. Ideally, the description should be sufficiently precise for evaluators to assess the probability that the described outputs and outcomes will have the desired influence.

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ESSAY

HOW COVID-19 AND CLIMATE CHANGE CHALLENGE ECONOMIC ASSUMPTIONS

Ian McAuley

Classification is a necessary aspect of public administration, but our regular contributor Ian McAuley explains why false dichotomies – such as the presumed trade-off between health and economic activity during the pandemic – and outdated categories of economic capital can have distorting and deleterious results.

The COVID-19 pandemic has been economically disruptive in two ways. First, its direct consequences have been a seven million global death toll, a setback to worldwide economic growth, and a reversal of progress in eliminating poverty. These are covered in reports by the World Health Organization, the International Monetary Fund and other agencies.

Second, the pandemic has also exposed fault lines in economic systems, addressed in this essay. In countries where public policy prioritised 'the economy' over public health, because of interdependence between a nation's health and its economic performance, there were setbacks in both domains: any assumed trade-off between 'health' and 'the economy' was revealed as a false dichotomy. As economic philosopher Karl Polanyi wrote in 1944, 'The economy is subsidiary to society: it does not sit alongside society'.[1]

The fragility of global supply lines and carefully calibrated Just In Time systems was exposed in goods ranging from crucial microelectronic circuits through to shipping containers. As the deadliness of the pandemic became evident, many countries took

1. Polanyi, 1944

measures to suppress it, revealing the dependence of economies on workers with basic skills, such as drivers and cleaners. Big conurbations, once seen as hubs of economic dynamism, became places to avoid, as mobile professionals retreated to the suburbs or rural settlements.

The counter-cyclical monetary and fiscal measures that governments usually apply to deal with recessions worked in a gross sense in avoiding a 1930s-type catastrophe, but they had perverse and unexpected consequences. In a typical business-cycle recession, low-interest rates should stimulate private investment and easy fiscal policy would be directed to nation-building projects or catching up on infrastructure development.

This was no business-cycle recession, however, where businesses and governments could make a reasonable prediction about the economy's recovery and invest with confidence. Until effective vaccines were developed, there was little sense in making plans for the future. Rational decision-makers in the private and public sectors can cope with business cycles for which risks can be reasonably and rationally quantified, but this recession was not amenable to statistical calculations of risk: it was a situation of uncertainty.

Had this recession been similar to past recessions, all the monetary and fiscal stimulus would have given a counter-cyclical spur to the real economy. Much of the stimulus, however, found its way into bidding up the price of existing assets: the US stock market peaked in January 2022, and in many Western countries house prices, already inflated before the recession, reached even higher levels. Already well-off households saw their balance sheets improve, while those with no financial buffers went backwards. As Thomas Piketty demonstrated, widening wealth inequality is a natural tendency of capitalism,[2] and inadvertently, policy responses to COVID-19 worsened that inequality.

Public spending saw the accumulation of vast levels of government debt, but without anything much on the public asset side of the balance sheet. There has been no 'New Deal' response to this recession.

As economies emerged from the pandemic, labour shortages emerged, but real wages did not rise. Much of the fiscal and monetary stimulus has made its way into profits rather than wages. That growth in corporate profits has been uneven, however: many businesses that had lost sales, from coffee shops to airlines, also became highly indebted during the long period of low interest rates.

Concerned with inflation, central banks have been raising interest rates to rein in excess liquidity. Governments in Western countries are pursuing conservative fiscal policies while dealing with normal budgetary demands for healthcare and income support for ageing populations. They also have the burden of accumulated government debt, incurring higher interest rates as central banks have tightened monetary settings.

In many countries, as a result of fiscal austerity, incomes for public sector workers in health care, education, aged care and other services have fallen behind the incomes of their private sector counterparts, even as COVID-19 made extra demands on services. As these human services are intrinsically labour-intensive, they become more costly than other goods and services, where productivity improvements have reduced their real costs as time passes. Moreover, they are bound to make more demands on public budgets because they are in the public sector.[3] An associated outcome is that gender pay issues have returned to the forefront of economic debates because the workforces in these industries are mainly female.

These have been the challenges posed by the COVID-19 recession: the pandemic has exposed fault lines in countries' economic arrangements.

2. Piketty, 2014
3. Baumol, 2012

Economic theories previously considered as verities have been revealed as conditional on neoliberalism's assumptions.[4]

In particular, much of 'rational actor theory' becomes irrelevant when people are faced with a situation looming as an existential threat on the scale of the Justinian Plague,[5] that requires mobilisation of community cooperation and yielding to the paternalistic hand of government. Neoliberalism, already dealt a blow during the 2008 global financial crisis, has become even more unfashionable, but no coherent economic theory is waiting to take its place.

As countries emerged from COVID-19, the other challenge, not easily handled in existing patterns of economic behaviour, has been the need to cope with climate change. That involves reducing nations' contribution to greenhouse gases, and building national resilience to its effects. On these counts, Australia has pressing needs: it must reduce its greenhouse gas emissions, which have been high in comparison with other industrialised countries; it has to cope with shrinking world demand for coal, and in the longer term less demand for gas, which have comprised more than half its exports; and it has to deal with increasing natural catastrophes and the need to shift some of its zones of agricultural production and settlement.

Whatever economic theories emerge in the coming years, economic reconstruction following COVID-19, and the need for transformative investments to cope with climate change, will demand economic resources. Investors will have to accept more modest returns in countries that have enjoyed high and easy profits from resource extraction, particularly 'settler societies' such as Australia. The industrial transition to cope with climate change should create many new investments and jobs, but profits and dividends will not flow for some time. Countries that have tried to get by on low taxes, such as Australia, will have to raise taxes just to sustain present levels of public services and raise taxes further to fund the public assets needed for a transformed industrial structure.

In terms of public policy, there is no easy 'Pareto' solution – a solution in which no one needs to bear any direct cost – on the table. There will be benefits in dealing with climate change and re-investing in the public sector, but these benefits are down the track, and many are in terms of avoiding losses. As behavioural economics confirms, delayed gratification is generally unappealing and loss-avoidance is hard for people to conceptualise (which is why public health had such a hard time competing for resources until an obvious threat loomed over the horizon).

RE-THINKING PRODUCTIVITY AND CAPITAL

One uncontentious response to these challenges is that there will be less sacrifice if productivity can be improved. To quote Paul Krugman's aphorism, 'Productivity isn't everything, but in the long run, it's almost everything'. In 'advanced' economies, including Australia, productivity growth, particularly labour productivity, has been slowing in this century.[6]

Increasing productivity is a necessary condition for restoring wage growth, but it is not a sufficient condition. If market-based capitalism is to retain its social licence and sustain a well-paid workforce buying its products, the benefits of productivity-improving investment must be distributed in a way that people accept as fair.

If labour productivity is to rise, there must be investment in capital. This is where re-thinking is needed for, as former Australian Science Minister

4. See, for example, Andrew et al., 2020
5. The plague of Justinian was first recorded major outbreak of the first plague pandemic in Europe and the Mediterranean.
6. World Bank, 2021

Barry Jones said, when we think of 'capital', we imagine something that hurts when you drop it on your toes. No doubt Karl Marx was bound by the same constraint, as was David Ricardo, who developed a classification of factors of production – land, labour and capital. In an economic system comprising large landowners, a plentiful supply of minimally skilled workers, and considerable physical capital such as factories and ships, these factors made a great deal of sense, but later attempts to trace economic outputs to distinct factors of production have led economists down confusing paths, littered with vague definitions and category errors.[7] Economies are interactively complex systems, not easily understood through reductionist simplifications. 'Capital' is one such simplification.

Had Marx or Ricardo walked into a business in the 1960s and seen a computer in operation, they would have been amazed by its analytical power, but they would have recognised the industrial setup with many people employed keeping the machine running. Labour was an adjunct to capital as it had been in their times. Had they come back sixty years later, however, and met an engineer with a hand-held device, their economic model would have been overturned. In many industries, labour has become the scarce factor, while the cost of physical capital has tumbled. The labour shortages manifested in the post-COVID recovery have highlighted this change.

Also, the nature of 'capital' has changed. It would be hard enough to convince Marx and Ricardo that something as light as a cellphone is productive capital, let alone many less physical forms of capital, including computer code, customer lists and intellectual property rights, the value of which has to be maintained through data protection, licences, patents and copyright. There were such protections in the 18th and 19th centuries, but the main barrier to ownership of capital was the cost of producing physical equipment.

The capital that makes engineers with hand-held devices productive is their human capital, mainly their education and accumulated skills. If there is a shortage of such people, they may extract some surplus above compensation for investment in university fees and years of forgone income. Human capital has probably accumulated from their associations, friendships and upbringing in a home where learning was encouraged. The American Marxist Jerry Muller would identify them as 'capitalists' because they own valuable capital and may extract surplus value from that capital.[8] By contrast, many still have little to offer, other than commodified labour, or basic generic skills, either on payrolls or as micro businesses in the gig economy.

This insight may seem self-evident: policymakers have talked about human capital for many years,[9] but it is not incorporated into public accounting and budgeting, which classify outlays on education and training as recurrent rather than capital outlays.

Another form of capital that is even harder to fit into the traditional classification of factors of production is social capital. The World Bank offers a definition aligning with most policymakers' understanding:

> **The social capital of a society includes the institutions, the relationships, the attitudes and values that govern interactions among people and contribute to economic and social development. Social capital, however, is not**

7. Marx conflated capital and labour into one factor, labour, considering capital equipment as the accumulation of labour inputs. Economists broadened the concept of land to incorporate all natural resources. Some added 'finance' as another factor although it is more easily seen as a facilitator of factors rather than a factor in itself. And it has become fashionable to add 'entrepreneurship' as a fourth factor, even though it is embodied in people, and can be considered as labour.
8. Muller, 2013
9. The term came into common use from Gary Becker's work *Human Capital: A Theoretical and Empirical Analysis, with Special Reference to Education* (Becker, 1975)

> **simply the sum of institutions which underpin society, it is also the glue that holds them together. It includes the shared values and rules for social conduct expressed in personal relationships, trust, and a common sense of 'civic' responsibility, that makes society more than just a collection of individuals.**[10]

Social capital is rightly described as 'capital' in that it yields ongoing benefits in building and sustaining trusting relationships, thereby reducing transaction costs, promoting knowledge sharing and increasing productivity.[11]

Social capital has public good properties in that it is generally non-excludable (non-contributors enjoy its benefits) and non-rival (it is not depleted by people enjoying its benefits). Although it may manifest in private markets through more straightforward contracts and less litigation, it will not automatically arise in private markets. Instead, it has to be nurtured and sustained through public policy.

In that regard, trust in government is a critical component of social capital. If people trust government to act with fairness and in the public interest, they are more likely to support well-considered economic policies and pay taxes to sustain public services that strengthen the economy and help distribute the benefits of economic activity more fairly.

CLASSIFICATION AND ACCOUNTING

Regarding classification, it is hard to force-fit human capital or social capital into traditional notions of 'capital'. This is more than a semantic point. Classifications have consequences because they influence the way public policy develops.

Classification of public investments in human and social capital – and for that matter, in preserving or remediating environmental capital – as 'recurrent' in public accounting has consequences. When governments are concerned with reducing accumulated public debt, and when there is a political focus on fiscal deficits, it is harder for a government to justify outlays on human and social capital than it would be if they were classified as 'capital' and presented as assets on the government balance sheet.

Maybe it is not feasible to make such a change in classification because it would clash with the basic concepts of accounting – conservatism, money measurement and materiality – which give accounting reports a certain consistency. If that constraint must be accepted, governments need to shift their reporting emphasis from figures such as budgetary cash surpluses and deficits towards a public balance sheet approach, where that balance sheet includes much that is not amenable to precise valuation. That would mean more emphasis on economic policy and less on fiscal policy in public debates.[12]

Classification is a necessary aspect of public administration. When it is based on false categorisation, however, as with the distinction between 'health' and 'the economy', or is based on 200-year-old definitions, as with a physical classification of 'capital', it can lead to poor policy outcomes. Reductionism is an aid to public policy, but its classifications should not drive public policy.[13] Policymakers need to look at society in ecological terms, as a system with inherently complex interrelationships and emergent properties, rather than in the reductionist way underpinning current classification systems.

10. World Bank, 1988
11. Productivity Commission, 2003
12. McAuley, 2016
13. Scott, 1998

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ESSAY

SECOND TRACK CASE STUDY: OECD WORKING PARTY ON SMES AND ENTREPRENEURSHIP

Olga Bodrova

The importance of SMEs to national economies and international trade was not reflected in the policy deliberations of major international economic institutions such as the OECD and World Bank until the early 1990s, when an early example of the Second Track process changed the status quo. Olga Bodrova recounts the origins of OECD's leading body on SME policies with insight from those who were there.

Major national firms and international corporations dominate the business headlines, yet it is small and medium-sized enterprises in OECD countries and across the globe, which account for over 99% of the total number of firms and most private sector jobs. In the United States, in December 2021, the Office of Advocacy of the US Small Business Administration (US SBA) showed that SMEs were responsible for 43.5% of gross domestic product (GDP)[1], while the SME sector remains the backbone of European Union economies and the engine of most new employment.[2]

While start-ups are seen as the fount of economic innovation, the entrepreneurialism of established SMEs puts them in the driving seat of transformational and innovative change. However, their smaller size, lack of collective organisations and low political profile also leave them vulnerable to mega-trends, less able to access finance – despite their more minor demands – and more overwhelmed by regulation. Their lack of resources also exposes them to 'black swan' events, such as the global economic lockdowns over 2020 – 2021 to contain the COVID-19 pandemic.

1. US Small Business Administration, Office of Advocacy, 2021
2. European Commission, n.d.

These challenges often mean the needs of SMEs are neglected in the political policy debate, and their interests are undermined by lobbyists from larger businesses and PR departments. Millions of SMEs and local entrepreneurs have no potential to be 'unicorns' but are nevertheless the mainstays of economic stability and social wellbeing.

The importance of SMEs to national and global economies was not reflected in the policy deliberations of major international economic institutions such as the OECD and World Bank for many years, and it took an early example of the 'Second Track' process for their importance to be more generally recognised and incorporated into economic policy formation.

WHAT IS SECOND TRACK?[3]

'Second track' backchannel diplomacy pre-dates formal diplomacy and the nation-state itself. It encompasses non-governmental, informal and unofficial contacts and activities between private citizens, groups of individuals or other 'non-state actors',[4] although, until the 1980s, the concept remained as informal as its practice. It is not a substitute for traditional diplomacy but can help official actors manage and even resolve conflicts by exploring possible solutions beyond formal negotiation.

State Department official Joseph V. Montville coined the phrase in 1981[5] at the height of the Cold War. He argued that 'track two' could 'reduce or resolve conflict, within a country or between countries, by lowering the anger or tension or fear that exists, through improved communication and a better understanding of each other's point of view'. The idea created a class of 'conflict resolution professionals' working through non-governmental organisations and universities to facilitate unofficial, unstructured interaction between stakeholders.

At its best, the process encourages an open-minded, altruistic and optimistic approach, nudging participants towards a best-case analysis unfettered by entrenched orthodoxies. It takes a positive view of people's underlying humanity, once job descriptions and national identities are stripped away, although it uses those trappings of power to put its plans into use. Common interests in science and culture can also cross political boundaries, softening the edges of diplomacy's inherent threat of force.

THE WORKING PARTY ON SMEs AND ENTREPRENEURSHIP

The Working Party on SMEs (WPSME) was created in March 1993 by the Organisation for Economic Co-operation and Development (OECD) to provide data and analysis to Member countries (24 at that time) for designing and implementing policies for SMEs that foster employment, competitiveness and growth. It was, at that time, a subgroup of the Industry Committee (IC). At the turn of the new decade, in 2002, to highlight the role of new enterprises in innovation and economic progress and the close integration of entrepreneurship in SME issues and policies, the **Working Party became Working Party on SMEs and Entrepreneurship (WPSMEE)**.

It was still a subgroup of the Committee on Industry, Innovation and Entrepreneurship (CIIE), but on **20 April 2021**, the OECD Council approved the upgrading of the Working Party to the status of a Level 1 Committee: it became the **Committee on SMEs and Entrepreneurship (CSMEE)**.[6]

The story of WPSME's establishment in 1993 offers a case study of the power of Second Track stakeholder engagement to fast-track solutions to critical issues.

3. Fritz, 2019, 2022
4. Davidson and Montville, 1981
5. Ibid.
6. OECD, 2021

We should remember that it was not until the second half of the 1980s that governments in most OECD countries took an interest in small and medium-sized enterprises as an essential source of jobs, innovation and growth. The OECD at the time had no specific interest in the issues facing small businesses. SMEs were rarely acknowledged nor represented at the OECD. The Organisation was focused on macro-economic policy and major corporations, rather than microeconomics which was not fashionable at the time. However, in 1988, France asked the OECD to undertake an international comparative analysis of the programmes and policies implemented by member countries concerning SMEs. Marie-Florence Estimé, then an Administrator in the Industry Division of the OECD's Directorate for Science, Industry and Technology (DSTI), was assigned to this project. While developing various works on SMEs, she started to alert OECD executives and government representatives about the lack of an official body dedicated to SMEs inside the Organisation.

During a visit to Australia in September 1992, while attending a Sydney conference on SMEs, Marie-Florence was introduced by Professor Chris Hall (University of Technology, Sydney) to an Australian businessman and philanthropist, Peter Fritz, a long-standing advocate for the interests of small businesses.

The pair discussed how the OECD could take a more active role in promoting the importance of SMEs and tailoring economic conditions to their needs, given the importance of small businesses in job creation, economic innovation and social cohesion. They acknowledged bureaucratic difficulties facing the OECD Secretariat, the permanent body of professionals working at the OECD, to convince member countries' government representatives of this need and create and launch an official body.

A month later, in Paris, at a meeting with the OECD DSTI Director, Peter convinced this decision-maker that creating an official body at the OECD focused on SMEs was essential. Support was also secured from Australia's Ambassador to France and Permanent Representative to the OECD in Paris, who agreed the idea had merit.

A month and a half later, in early December 1992, at the Australian Embassy, a formal meeting was arranged with all the OECD member countries around the table to discuss the creation of an official body. Within a day, the idea was not only decided but a first draft of the mandate of the future Working Party was prepared. Exactly three months later, in March 1993, after approval of the final mandate by the OECD Council, the Organisation's governing body, the Working Party, was officially created and held its first session.

The process took less than six months by working through 'second track' channels where willing individuals cooperate to find and implement solutions to common problems, rather than the traditional organisational structures' 'first track' approach. The push to promote SMEs took vision, but just as importantly, a practical outlook, the use of personal networks and the power of persuasion to make things happen and to progress issues.

The Working Party broadened the scope of the OECD and extended its reach significantly. The new body sought contributions from small businesspeople and entrepreneurs, rather than merely speaking on their behalf, and channelled their feedback to the policymakers to establish a meaningful dialogue.

WPSME formed the centre of OECD work on the role played by small businesses in a globalising economy characterised by increasingly rapid market and technological change. The recession experience in the early 1980s and 1990s had also demonstrated SMEs' leading role in job creation by countering the negative effects of job losses in larger firms.

The group initially undertook a comprehensive analysis of SME policies and issues at the national and international levels. This led to the creation of a comprehensive analytical framework identifying best practice policies in member countries which informed a series of reports, including the OECD Manual for the Evaluation of SME and Entrepreneurship Policies.

The Working Party also focused on the potential and promotion of women's entrepreneurship. It was a pioneer in organising the first OECD major international conference on this topic in 1997, which issued a report and a set of policy recommendations much appreciated by member countries. A second international conference was organised in 2000, assessing the progress and emerging issues at the turn of the century.

THE OECD BOLOGNA PROCESS ON SMEs[7]

Research published by the WPSME led, at the invitation of the Italian Government, to the first OECD Ministerial Conference on SMEs in Bologna, Italy, on 13-15 June 2000.[8] Entitled 'Enhancing the Competitiveness of SMEs in the Global Economy: Strategies and Policies', the event explored innovation and e-commerce, among other issues. Forty-nine member and non-member countries participated, and SME and Industry ministerial representatives adopted the 'Bologna Charter on SME Policies'.[9]

The Bologna Ministerial Conference was also held alongside a Business Symposium which brought together many representatives of the global SME sector.

The Bologna Ministerial Conference allowed the OECD to open a high-level dialogue among policymakers, the business community, and national and international organisations and institutions on ways for SMEs to reap the benefits of globalisation and technological progress while building on their local strengths. The event also strengthened partnerships between SMEs and SME policy makers in OECD member countries, emerging economies and developing countries.

The Bologna conference was the start of what came to be known as 'the OECD Bologna Process on SME and Entrepreneurship Policies'. This OECD Bologna Process maintained its momentum with the second Ministerial Conference, held in Istanbul in June 2004, at the invitation of the Turkish Government, which saw 72 countries participate and sign the 'Istanbul Ministerial Declaration on Fostering the Growth of Innovative and Internationally Competitive SMEs'.[10] The conference also led to the development of an evaluation framework of SME programmes and policies, the improvement of SME data and statistics with an emphasis on financing SMEs, female entrepreneurship, and additional work on SME globalisation.

Underlining the growing importance of this policy area, in July 2004 the OECD Council created the *Centre for Entrepreneurship, SMEs, and Local Development (CFE)*[11] to promote the OECD's work on SMEs and entrepreneurship[12] and link the secretariats serving the Working Party, the Local Economic and Employment Development Committee and the Tourism Committee.

7. OECD (n.d)
8. OECD, 2000
9. They also agreed, by the same token, at an Italian Government initiative, the International Network for SMEs (INSME), which became in 2004 an Association that acts as a facilitator for the creation of public-private partnership, a gateway to innovation good practices for the support of SMEs and entrepreneurship.
10. OECD, 2022a
11. In 2017, The Centre for Entrepreneurship, SMEs, and Local Development (CFE) became the Centre for Entrepreneurship, SMEs, Regions and Cities (CFE)
12. https://www.oecd.org/industry/smes/

A significant amount of research work was undertaken following the recommendations issued on the various topics by the Istanbul Ministerial Conference, and reports were presented at high-level conferences tackling questions such as *SME and Entrepreneurship Financing* (Brasilia, March 2006), *SME Access to International Markets* (Athens, November 2006), and the Role of SMEs in Global Value Chains (Tokyo, June 2007). *The Bologna +10 High-level Meeting on SMEs and Entrepreneurship* in 2010 in Paris took place on the occasion of the 10th anniversary of the Bologna Ministerial to design a roadmap to help governments recover from the crisis and to secure sustainable growth over the longer term.

Overall, these reports and events have raised the profile of SME and entrepreneurship policies and helped governments set out policies to support and encourage the sector.

Ongoing initiatives include the *OECD Scoreboard on Financing SMEs and Entrepreneurs*,[13] which collates data from 48 countries on SME lending, financing conditions and policy initiatives and is now in its tenth edition. The OECD SME and Entrepreneurship Outlook report presents the latest trends in the performance of SMEs and entrepreneurs and relevant business conditions and policy frameworks in an increasingly digitalised and globalised world.

The Working Party initiated an OECD SME and Entrepreneurship Strategy in 2019 to help develop principles for effective, efficient and coherent SME and entrepreneurship policies.

Finally, during the COVID-19 pandemic, WPSMEE prepared periodically updated notes on the economic outlook for SMEs and analysis of emergency support measures and SME policy approaches in OECD Member countries

LEVEL 1 COMMITTEE ON SMEs AND ENTREPRENEURSHIP

On 27 April 2021, the OECD Council elevated the Working Party to the status of a full Committee reporting directly to Ambassadors, signalling the critical role SMEs can play in driving a sustainable, inclusive, green, and resilient post-COVID recovery.

The initiative was launched by New Zealand and attracted strong backing among the 38 Member countries, including dozens of letters of support from Government Ministers and international and national business agencies. This promotion in status was another significant milestone and a triumph for the Second Track process, as it was the result of many years of relentless advocacy from the OECD CFE Secretariat, in particular, Lucia Cusmano, in charge at the CFE of the WPSMEE, and Lamia Kamal-Chaoui, Director of the OECD CFE, and from several individual country member representatives, as well as Sergio Arzeni, former Director of the OECD CFE and current president of INSME.

The new Committee will strengthen the voice of small business and entrepreneurship in OECD policy making and help level the field with big business. It shows that the OECD continues to acknowledge their potential, the challenges they face, and the need to incorporate the needs of SMEs throughout international and national tax, environmental, education, innovation, investment, trade, employment, and social and industrial policies.

The OECD's then Secretary-General, Angel Gurría, said the new Committee would strengthen the Organisation's ability to support member countries in their inclusive economic recovery planning. 'SMEs and entrepreneurs hold the key to sustainable and inclusive growth, and as such, they need to be front and centre in the economic recovery,' he said. 'The new Committee on SMEs and Entrepreneurship provides the right institutional structure to respond to members' needs and enhance the impact of this vital OECD work.'

13. OECD, 2022b

THE IMPORTANCE OF THE SECOND TRACK

International and national policy-making for the SME sector entails evaluating data, framing regulations and setting up programmes to improve SME performance. However, first-track processes in government departments are dominated by politicians and bureaucrats, few of whom will have any experience running a small business. If those policy deliberations do not incorporate and listen to the SMEs' voices, they risk being ineffective and even counterproductive. The Second Track offers a mechanism for SME owners and managers to offer their experience and ideas first-hand to decision-makers and incorporate the advice of academics, business experts and additional stakeholders.

Although in its infancy at the time, the Second Track process not only helped create the OECD Working Party on SMEs and secure its recent elevation to full Committee status[14] but offered a methodology through which its work could be improved by incorporating a more comprehensive range of voices and demanding implementation on the ground.

ACKNOWLEDGEMENTS

The author extends special thanks to Marie-Florence Estimé, former Deputy Director of the OECD Centre for Entrepreneurship, SMEs and Local Development, and Jean-Luc Vo Van Qui, the Chair of the OECD Working Party on SMEs in 1998-2002, for their assistance in the production of this article.

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